Air Dispersion Modeling Guidelines
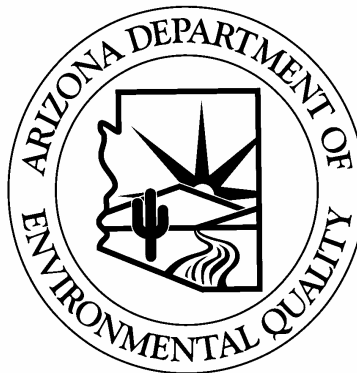# for
Arizona Air Quality Permits

PREPARED BY:

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APPENDICES

1.0   INTRODUCTION

This guidance document has been developed by the Air Quality Division (AQD) of the Arizona Department of Environmental Quality (ADEQ) to document air quality modeling procedures for air quality permit applications for sources located in Arizona under ADEQ jurisdiction. This guidance provides assistance to applicants required to perform modeling analyses to demonstrate that the air quality impacts from new and existing sources protect public health, general welfare, physical property, and the natural environment.

It is assumed that the reader of these guidelines has a basic knowledge of modeling theory and techniques. At a minimum, individuals responsible for conducting an air quality modeling analysis should be familiar with the following documents:

- *Guideline on Air Quality Models* as codified in 40 CFR 51, Appendix W,
- *New Source Review Workshop Manual (EPA, 1990),*
- *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources (EPA, 1992),*
- Guidance issued by the EPA Office of Air Quality Planning and Standards (OAQPS),
- Guidance issued by EPA Region 9, and
- User's guides for each dispersion model.

This publication replaces the previous edition of ADEQ's *Modeling Guidelines (ADEQ, 1998).* This guidance clarifies issues described in EPA documents, facilitates the applicant in developing an acceptable modeling analysis, and assists ADEQ in expediting the permit review process. The guidelines also outline additional modeling requirements specific to ADEQ.

While ADEQ has attempted to address as many issues as possible, each modeling analysis is still treated on a case-by-case basis. Therefore, the applicant should work closely with ADEQ staff to ensure that all modeling requirements are met. If the applicant can demonstrate that techniques other than those recommended in this document are more appropriate, the AQD may approve their use. ADEQ reserves the right to make adjustments to the modeling requirements of each permit application on case-by-case basis.

This document will be amended periodically to incorporate new modeling guidance and changes to regulations. In the future, the document may need further revisions to incorporate the proposed ambient standard for particulates with diameters less than or equal to 2.5 microns (PM 2.5), additional changes to the New Source Review (NSR) Regulations, and potential new guideline models such as AERMOD and ISC-PRIME.

1.1   Overview of Regulatory Modeling

Air dispersion modeling is utilized to predict ambient impacts of one or more sources of air pollution. Equations and algorithms representing atmospheric processes are incorporated into various dispersion models. The equations and algorithms used in the models are based on both known atmospheric processes and empirical data. ADEQ uses the results of modeling analyses to determine if a new or existing source of air pollutants complies with state and federal maximum ambient concentration standards and guidelines. Air dispersion models are useful in properly designing and configuring sources of pollution to minimize ambient impacts.

Regulatory models are used to predict the highest concentrations expected to occur from a source. For this reason, regulatory models are designed to be conservative. That is, they are designed to over-predict ambient impacts that might occur in real-world situations. Because the models may over-predict ambient concentrations, a modeled prediction alone does not necessarily indicate a real-world pollution condition. However, a modeled prediction of an exceedance of a standard or guideline may indicate the possibility of potential real-world air quality violations. Therefore, a modeled prediction of an exceedance of a standard or guideline value may be used as the basis to modify allowable emission rates, stack parameters, operating conditions, or to require state implementation plan review for criteria pollutants.

1.2   Purpose of an Air Quality Modeling Analysis

An air quality modeling analysis is used to determine that criteria pollutants emitted from a source will not cause or significantly contribute to a violation of any National Ambient Air Quality Standard (NAAQS) or PSD increment. An overview of PSD modeling analyses is provided in Section 6.0. An overview of modeling analyses required by ADEQ for non-PSD sources is described in Section 5.0. Air quality modeling analyses may also be required to:

- Appropriately locate air quality monitors,

- Determine the impacts on Class I and Class II Areas as a result of emissions from new of modified sources,

- Determine if, for any pollutant, a concentration will exist that may pose a threat to public health or welfare or unreasonably interfere with the enjoyment of life or property (e.g. odor), or

- Perform a human health or ecological risk assessment.

1.3   Authority for Modeling

ADEQ receives the authority to require air dispersion modeling for new major sources and major modifications to existing sources from the Arizona Administrative Code (AAC), R18-2-407. In addition, the Arizona Laws Relating to Environmental Quality, A.R.S. §49-422, describes the broad powers of the ADEQ Director related to the quantification of air contaminants. These powers allow the Director to require a source of air contaminants, by permit or order, to quantify its emissions of air pollution that may reasonably be attributed to such a source. Therefore, on a case-by-case basis, ADEQ also requires that permit applicants perform modeling analyses for both minor sources and minor modifications.

1.4   Acceptable Models

In general, ADEQ adheres to EPA's *Guideline on Air Quality Models* codified in 40 CFR 51, Appendix W, to determine acceptable models for use in air quality impact analyses. This document provides guidance on appropriate modeling applications. As new models are accepted by EPA, the *Guideline on Air Quality Models* is updated.

ADEQ reserves the right to evaluate the use of unapproved models on a case-by-case basis. Depending on the situation, the model evaluation may require the approval by EPA Region IX and/or public review. Until final approval from EPA as noticed in the Federal Register, prior approval should be sought from ADEQ regarding the use of ISC-PRIME and AERMOD.

More information regarding dispersion modeling, including models available for download, is available at EPA's Support Center for Regulatory Air Models (SCRAM) website at http://www.epa.gov/ttn/scram.

1.5 Overview of Modeling Protocols and Checklists

Modeling protocols and guidance checklists outline how modeling analyses should be conducted and how a modeling analysis will be presented. It is through such documents that ADEQ hopes to expedite the permitting process, ironing out all the fine points of emissions and air quality modeling before, rather than after, the technical work begins. Protocols should address relevant modeling requirements and recommendations from state/federal regulations and air quality modeling guidelines.

ADEQ recognizes that many air quality specialists have their own preferred formats for protocols. ADEQ does not wish to require permit applicants to use a specific modeling protocol format.   Instead, ADEQ has generated a listing of typical protocol elements as an aid in developing a modeling protocol. This listing does not address all possible components of a protocol. Case-by-case judgments should be used to decide if additional aspects of the analysis should be included in the protocol or if certain elements are not necessary in a given situation. An example list of modeling protocol elements is provided in Appendix C.

Prior to commencing a refined modeling or PSD modeling analysis, the applicant must submit a modeling protocol to ADEQ for approval. ADEQ will not accept a refined modeling analysis without a pre-approved modeling protocol. Please submit three copies of the modeling report to ADEQ. Depending on the project, additional copies may also be requested by EPA Region 9 and the Federal Land Manager.

The applicant should allow two weeks for review by ADEQ. Upon review, the applicant will receive notification of acceptance of the modeling approach, as well as guidance on any outstanding issues.   However, the applicant should understand that an approved modeling protocol does not necessarily limit the extent of the modeling that will be required to demonstrate compliance with applicable standards.

1.6 Overview of Modeling Reports

In most cases, the approved modeling protocol may serve as the foundation of the modeling report. Please be sure that each modeling report includes a discussion of each relevant modeling protocol element listed in Appendix C. In addition, please include several graphics in the modeling report which indicate facility impacts relative to surrounding terrain, residences, schools, etc. Graphics showing building layouts, source locations, and process area boundaries are also required. Please submit three copies of the modeling report to ADEQ. Depending on the project, additional copies may also be requested by EPA Region 9 and the Federal Land Manager.

In addition, please provide ADEQ all electronic modeling files including model input files, model output files, model plot files, building downwash files, meteorological data files, etc. The electronic modeling files should utilize the general file formats described in the model user's guides. In other words, modeling files provided to ADEQ should be formatted so that they can be directly processed using EPA's DOS executables from the SCRAM bulletin board (http://www.epa.gov/ttn/scram). The electronic files should not be submitted in a format specific to proprietary modeling software programs which do not precisely follow the formats described in user's manuals for models such as ISCST3 and BPIP.

2.0   LEVELS OF MODELING ANALYSIS SOPHISTICATION

Two levels of modeling sophistication (screening and refined modeling) may be used to demonstrate compliance with ambient standards and guidelines. Modeling analyses vary widely in complexity based on the type of source being modeled. A simple modeling analysis might include the consideration of a single smokestack that could be considered using a screening model. A complex analysis can include several hundred smokestacks, roads, fugitive sources, and regional sources. A complex analysis would require a refined model to simulate ambient impacts.

2.1   Screening Modeling

The first level of sophistication involves the use of screening procedures or models. Screening modeling is the quickest, easiest way to show compliance with air quality standards and guidelines. Screening models use simple algorithms and conservative techniques to determine whether the proposed source will cause or contribute to the exceedance of an air quality standard or guideline.

Screening models are usually designed to evaluate a single source or sources that can be co-located (see Section 3.3.8). When screening models are utilized for multiple sources, it is necessary to model each source separately and then add maximum impacts from each model run to determine an overall impact value. Results utilizing this methodology are expected to be conservative since the maximum impacts from each modeled source (regardless of different impact locations at different times) are summed together for a total impact value from a facility. Screening programs are generally limited in their ability to evaluate terrain impacts and downwash effects from multiple buildings. However, for relatively simple sources, such as a single source with little or no elevated terrain and few downwash structures, these models will provide conservative estimates of downwind concentrations.

The current recommended model for screening sources in simple terrain is the most recent version of EPA's SCREEN3 model (or its successor). The SCREEN3 model can be downloaded from EPA's   Support   Center   for   Regulatory   Air   Models   (SCRAM)   website   at http://www.epa.gov/ttn/scram. SCREEN3 is a steady-state, single-source, Gaussian dispersion model developed to provide an easy-to-use method of obtaining pollutant concentration estimates. SCREEN3 is an EPA-approved screening model for estimating impacts at receptors located in simple terrain and complex terrain due to emissions from simple sources. The model is capable of calculating downwind ground-level concentrations due to point, area, and volume sources. In addition, SCREEN3 incorporates algorithms for the simulation of aerodynamic downwash induced by buildings. The model utilizes a range of worst-case meteorological data rather than using site-specific meteorological conditions.

The permit applicant and in some instances, ADEQ may conduct an initial screening analysis of a source. The minimum information required for ADEQ to perform in-house evaluations is provided in Appendix D.

The screening analysis should be consistent with the guidance contained in EPA's *Guideline on Air Quality Models* and appropriate screening modeling documents such as the *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources (EPA, 1992).*

The output from typical screening models identifies short-term (1-hour average) maximum impacts. Conversion factors, also referred to as persistence factors, need to be applied to these maximum 1-

hour values to determine other averaging periods of concern. Separate conversion factors have been recommended by EPA for terrain below stack tip (simple terrain) and terrain above stack tip (complex terrain). Table 1 presents the EPA recommended conversion factors for simple and complex terrain.

Table 1. Conversion Factors for Simple Terrain Screen Modeling

Model Output	Desired Averaging Period						
	1-hour	3-hour	8-hour	24-hour	Month	Quarter	Annual
Simple 1-hour	1.0	0.9	0.7	0.4	0.18	0.13	0.08
Complex 1-hour	1.0	0.7	---	0.15	---	---	0.03

Depending on the model chosen, the complex terrain option may output concentrations as 24-hour average values. In this case, it is necessary to convert the 24-hour values to determine other averaging periods of concern.

If a screening analysis indicates that the predicted concentrations from a source exceed a standard, guideline, a *de minimus* amount, or staff-identified percentage of a standard of guideline, the applicant should work with the AQD to determine if either refined modeling or reasonable changes to the facility would be appropriate to limit ambient impacts. Ambient impacts can be reduced by reducing emissions, reducing hours of operation, increasing stack heights, increasing stack airflows, etc. If modifications to the facility are not feasible or unreasonable, it is necessary to refine the modeling results using a higher level of modeling sophistication. In this case, a refined modeling analysis is warranted.

2.2   Refined Modeling

ADEQ may determine that refined modeling is necessary if the results of the screening or refined screening analysis indicate that the predicted concentrations from a source exceed a standard, guideline, a *de minimus* amount, or staff-identified percentage of a standard of guideline. It is typically the applicant's responsibility to perform refined modeling. However, ADEQ may perform this type of modeling under certain circumstances, such as for small businesses that cannot afford the costs associated with refined modeling or for other reasons. Before a refined modeling analysis is performed, ADEQ requires that the applicant submit a written modeling protocol that describes the methodologies to be utilized in the modeling analysis.

Refined modeling requires much more detailed inputs and complex models to calculate ambient impacts than screening modeling. The primary models used for the refined modeling are the most recent versions of EPA's Industrial Source Complex Short-Term 3 (ISCST3) and ISC Long-Term 3 (ISCLT3) model (or their successors). Currently, the ISC models can be downloaded from EPA's Support Center for Regulatory Air Models (SCRAM) website at http://www.epa.gov/ttn/scram.

ISCST3 is a steady-state, multiple-source, Gaussian dispersion model. ISCST3 is the EPA-preferred refined model for estimating impacts at receptors located in simple terrain and complex terrain (within 50 km of a source) due to emissions from complicated sources. ISCST3 can predict ambient concentrations using onsite, representative, or worst-case meteorological data

sets. The ISCST3 model is capable of calculating downwind ground-level concentrations due to point, area, and volume sources and can accommodate a large number of sources and receptors. ISCST3 incorporates algorithms for the simulation of aerodynamic downwash induced by buildings and can also address complex terrain using built-in COMPLEX-I model algorithms. The ISCST3 model does not handle atmospheric chemistry processes. Modeling involving pollutant transformations (i.e. ozone, sulfates, etc.) is not generally required for new or modified sources and is not addressed in this guidance document.

The ISC model should always be run in the regulatory default mode unless otherwise approved by ADEQ. In addition, commercial versions of this model that include user-friendly input interfaces are also acceptable if EPA has granted modeling equivalency.

The CALPUFF model is typically used to assess impacts at Class I areas. CALPUFF incorporates more sophisticated physics and chemistry and requires more extensive data input than ISC. CALPUFF is a multi-layer, multi-species non-steady-state puff dispersion model that simulates the effects of time- and space-varying meteorological conditions on pollution transport, transformation and removal.

CALPUFF can be applied on scales of tens to hundreds of kilometers. It is currently used for long range transport assessments (greater than 50 km from the emission source). It includes algorithms for sub-grid scale effects (such as terrain impingement), as well as longer range effects (such as pollutant removal due to wet scavenging and dry deposition, chemical transformation, and visibility effects of particulate matter concentrations). The *User's Guide for the CALPUFF Dispersion Model (ET, 2000)* provides more information on the CALPUFF model.

3.0   MODELING ANALYSIS FEATURES

This section provides an overview of the major components of a permit modeling analysis. Model user's guides may also be useful in providing the applicant detailed information regarding features of a modeling analysis. When in doubt, modeling questions should be presented to ADEQ for assistance.

3.1   Modeling Worst-Case Scenarios

For each applicable pollutant and each applicable averaging time, a modeling analysis must consider worst-case scenarios based on:

- Different operating modes of equipment (e.g. simple cycle and combined cycle for turbines),

- Various emission rates (normal steady-state operations, start-up and shutdown operations, emissions at various loads, spikes in short-term emissions, etc.), and

- The effect of various operational loads on emission rates and dispersion characteristics.

3.1.1   Emissions Profiles

The maximum short-term emission rates for each source should be used to demonstrate compliance with all short-term averaging standards and guidelines. In addition, emission rates for the annual averaging period need to incorporate a suitable number of these high-emission periods combined with normal equipment operations. For example, on an annual basis, power generation facilities are typically permitted for a certain number of start-up and shut-down events. Therefore, annual emissions calculations for a power generation facility must consider the emissions from start-up and shut-down events combined with emissions from steady-state operations.

It is important that the applicant provide emissions information for all averaging times to be considered in the modeling analysis. Potential short-term emissions "spikes" from highly fluctuating short-term emissions sources (such as some types of kilns) also need to be characterized and considered in the modeling analysis.

3.1.2   Loads Analyses

A loads analysis is also required for equipment that may operate under a variety of conditions that could affect emission rates and dispersion characteristics. A loads analysis is a preliminary modeling exercise in which combinations of parameters (e.g. ambient temperature, sources loads, relative humidity, etc.) are analyzed to determine which combination leads to the highest modeled impact. For example, turbines should be evaluated at varying loads and temperatures to determine the worst-case modeled impacts.

3.1.3   Emission Caps

Some facilities may wish to accept facility-wide emissions caps for a particular pollutant. However, emissions of these pollutants may exhaust into the atmosphere through various stacks. Different stacks with different dispersion parameters may result in significantly different ambient impacts, especially in complex terrain. Many operational possibilities exist under a proposed facility-wide cap. To adequately evaluate the ambient impacts of variable emissions of pollutants with facility-wide caps, the applicant needs to consider several operational scenarios.

For example, assume that two stacks, Stack A and Stack B, have very different dispersion differences (i.e. different stack heights, airflows, and exhaust diameters). Assume that Stack A typically emits 25% of the emissions and Stack B emits 75% of the emissions from the

throughput in a single production unit. Assume that it is possible to configure the production unit so that Stack A is bypassed and all of the emissions exhaust through Stack B (and vice versa). Under this scenario, the applicant should consider the following modeling scenarios in addition to the aforementioned typical operating scenario: (a) 100% of emissions through Stack A only, (b) 100% of emissions through Stack B only, and (c) 50% of emissions through Stack A and 50% of emissions through Stack B. In other words, the applicant needs to determine and separately present worst-case modeled impacts resulting from various operating scenarios, since a facility-wide cap would allow for such operational flexibility.

These analyses are intended to demonstrate that the health and welfare of the public will be protected from all conceivable operating scenarios from a proposed project.

3.2   Modeling Emissions Inventory

The modeling emissions inventory may consist of the emission points of the sources to be permitted, as well as other applicable onsite and offsite sources. An organized emissions inventory provides a crucial link between the emissions used to determine source applicability and the emissions used directly in the modeling analysis. Applicants are required to calculate emissions for proposed projects and compare these values to trigger thresholds for PSD applicability, MACT applicability, etc. Typically, these emissions calculations are presented as annual emissions with units of ton/yr. On the other hand, modeling analyses typically utilize emission rates with units of lb/hr or g/sec.

The averaging periods over which ambient standards and guidelines apply vary depending upon pollutant type. For example, emissions over 1-hour and 8-hour periods would be needed to compare the ambient impact of carbon monoxide emissions with the one hour and eight hour standards for carbon monoxide. For sulfur dioxide, short-term ambient standards are in terms of 3-hour and 24-hour averaging periods. Emission inventories should be tabulated for all the different averaging periods applicable to pollutants emitted from a facility.

To expedite ADEQ's review of the permit application and associated modeling analysis, it is suggested that the applicant calculate lb/hr, ton/yr, and g/sec emission rates for all averaging times in the same (or similar) tables. These emissions tables should also include operational limits (hr/day, hr/yr) and production material throughputs and/or unit ratings for each emission source. Emissions units are typically considered on a production unit basis while modeling requires the consideration of exhaust points. It is possible to have several production units that exhaust to a common exhaust point. Therefore, emissions should be presented in the permit application so that it is possible to determine source applicability while also clearly indicating the calculations utilized to determine modeled emission rates for each exhaust point at the facility.

From ADEQ's experience with several permits, this approach to calculating emissions greatly reduces permit review time and saves the applicant additional work associated with data requests from ADEQ. See the example in Appendix D for more details.

3.3   Types of Sources

Regulatory modeling should reflect the actual characteristics of the proposed emission sources. Several different source types used to characterize emissions releases are described in this section.

3.3.1 Point Sources

The point source is the most common type of source that is modeled in permit modeling analyses. Emissions from point sources are released to the atmosphere through well-defined stacks, chimneys, or vents. The following stack parameters are needed to model point sources: emission rate, inside stack diameter, stack height above grade, exhaust flow rate of velocity, and exhaust temperature. Other parameters related to nearby buildings and structures (building height, width, length, and location with respect to the stack) may also be required to evaluate the effects of building downwash.

3.3.2 Volume Sources

Volume sources are used to model releases from a variety of industrial sources such as building roof monitors, multiple vents, conveyor belts, roads, drop points from loaders, and material storage piles. The following parameters are needed to model volume sources: emission rate, source release height above ground (h_e), the initial lateral dimension of the volume (σ_{yo}), and the initial vertical dimension of the volume (σ_{zo}). The release height of a volume source is the height of the center of the volume source above grade. Determination of the initial lateral and vertical dimensions (referred to as initial sigmas) are based on the geometry and location of the source. The actual physical dimensions of the release (i.e actual height, actual width, and actual length) are adjusted to generate the initial lateral and vertical dispersion parameters for use in the model. The base of a volume source must be a square. If the source cannot be characterized as square, then the source should be characterized as a series of adjacent volume sources. For relatively uniform sources, determine the "equivalent square" by taking the square root of the area of the volume base.

Table 2 provides a summary of the suggested procedures for estimating the initial lateral dimensions and initial vertical dimensions for volume and line sources as presented in the *User's Guide for the Industrial Source Complex (ISC3) Dispersion Models (EPA, 1995).*

Table 2. Suggested Procedures for Estimating Volume Source Parameters

Type of Source	Procedure for Obtaining Initial Dimension
Initial Lateral Dimensions (σ_{yo})	
Single Volume Source	σ_{yo} = length of side divided by 4.3
Line Source Represented by Adjacent Volume Sources	σ_{yo} = length of side divided by 2.15
Line Source Represented by Separated Volume Sources	σ_{yo} = center to center distance divided by 2.15
Initial Vertical Dimensions (σ_{zo})	
Surface-Based Source ($h_e \sim 0$)	σ_{zo} = vertical dimension of source divided by 2.15
Elevated Source ($h_e > 0$) on or Adjacent to a Building	σ_{zo} = building height divided by 2.15
Elevated Source ($h_e > 0$) not on or Adjacent to a Building	σ_{zo} = vertical dimension of source divided by 4.3

3.3.3   Area Sources

Area source algorithms are used to model low level or ground level releases with no plume rise such as storage piles, slag dumps, and lagoons. Some models are only capable of treating area sources as rectangles while others are capable of treating area sources multi-sided polygons. The following parameters are needed, at a minimum, to model rectangle area sources: area emission rate, source release height above ground, length of X side of area, and length of Y side of area. The applicant should note that a 10:1 aspect ratio of length to width must not be exceeded when producing rectangular area sources. If this ratio is exceeded, the area being modeled should be subdivided accordingly to achieve the 10:1 aspect ratio limitation.

It should also be noted that the emission rate for the area source is an emission rate per unit area, which is different that the point and volume source emission rates, which are total emissions for the source.

3.3.4   Road Emission Sources

ADEQ may require modeling of fugitive road dust for both short-term and annual averaging periods. If modeling of roads is required, road emissions can be represented as a series of volume sources. ADEQ follows the volume source technique utilized by the Texas Commission on Environmental Quality (TCEQ) for modeling road emissions (TCEQ, 1999) with a few minor exceptions. The following road modeling approach is utilized by ADEQ:

Do not include road emissions in permit modeling analyses if:

- They will not be generated in association with transport, storage, or transfer of materials (raw, intermediate, and waste), including sand, gravel, caliche, or other road-based aggregates, *and*

- The AQD omits them from the modeling demonstration because the applicant will use best management practices to control them.

To represent road emissions by volume sources, follow the eight steps described in the following paragraphs.

Volume Step 1: Determine the adjusted width of the road. The adjusted width is the actual width of the road plus 6 meters. The additional width represents turbulence caused by the vehicle as it moves along the road. This width will represent a side of the base of the volume.

Volume Step 2: Determine the number of volume sources, N. Divide the length of the road by the adjusted width. The result is the maximum number of volume sources that could be used to represent the road.

Volume Step 3: Determine the height of the volume. The height will be equal to twice the height of the vehicle generating the emissions – rounded to the nearest meter.

Volume Step 4: Determine the initial horizontal sigma for each volume.

- If the road is represented by a single volume source, divide the adjusted width by 4.3.

- If the road is represented by adjacent volume sources, divide the adjusted width by 2.15.

- If the road is represented by alternating volume sources, divide twice the adjusted width – measured from the center point of the first volume to the center point of the next represented volume – by 2.15. Start with the volume source nearest the process area boundary. This representation is often used for long roads.

Volume Step 5: Determine the initial vertical sigma. Divide the height of the volume determined in Step 3 by 2.15.

Volume Step 6: Determine the release point. Divide the height of the volume by two. This point is the center of the volume.

Volume Step 7: Determine the emission rate for each volume used to calculate the initial horizontal sigma in Step 4. Divide the total emission rate equally among the individual volume sources used to represent the road, unless there is a known spatial variation in emissions.

Volume Step 8: Determine the UTM coordinate for the release point. The release point location is in the center of the base of the volume. This location must be at least one meter from the nearest receptor.

3.3.5 Flares

Flares are typically modeled similar to point sources. However, the heat release from the flare is utilized to calculate plume rise. For screening purposes, the flare options in the SCREEN3 and TSCREEN models are acceptable. For refined modeling, it is necessary to compute equivalent emission parameters (i.e. adjusted values of temperature, stack height, and diameter) to account for the buoyancy of the plume since the flare option is not available in the ISCST3 model.

Several methods for computing equivalent emission parameters appear in the literature. However, it does not seem that any one method is universally accepted. The technique to calculate the buoyancy flux for flares general follows the technique described in the *SCREEN3 User's Guide (EPA, 1995)* and *Ohio EPA's Air Dispersion Modeling Guidance*. In general, use the following parameters to model a "typical" flare:

- Effective stack exit velocity = 20 meters per second

- Effective stack exit temperature = 1273 Kelvin

- Adjust the stack height and inside diameter to account for the flame height and the buoyancy of the plume by using the following equations:

$$H_{equiv} = H_{actual} + 0.944(Q_c)^{0.478}$$

$$D_{equiv} = 0.1755(Q_c)^{0.5}$$

where,

H_{equiv} = equivalent release height of the flare, in meters
H_{actual} = actual height of the flare stack above grade, in meters
Q_c = heat release of the flare, in MMBTU/hr
D_{equiv} = equivalent diameter of the flare, in meters

This method pertains to the "typical" flare. The method will be relatively accurate depending on flare parameters such as heat content, molecular weight of the fuel, and velocity of the uncombusted fuel/air mixture. Hence, this method may not be suitable for all conceivable situations. In this case, the applicant may submit a properly documented method for consideration by ADEQ.

3.3.6 Open Pit Sources

Open pit algorithms are used to model particulate emissions from open pits, such as surface copper mines and rock quarries. These algorithms simulate emissions that initially disperse in three dimensions with little or no plume rise. Open pit algorithms are available in some refined models such as ISCST3. In the ISCST3 model, the open pit algorithm uses an effective area for modeling pit emissions based on meteorological conditions. The algorithm then utilizes the numerical integration area source algorithm to model the impact of the emissions from the effective area sources. The following parameters are needed to model open pit sources: open pit emission rate (emission rate per unit area), average release height above the base of the pit, the initial length and width of the pit, and the volume of the pit.

3.3.7 Pseudo-Point/Non-Standard Point Sources

Non-standard source emissions are not specifically addressed with most models. For example, if obstructed or non-vertical stack sources must be modeled, the source should be alternatively characterized to represent the release point. If a point source is still assumed, even though the stack exhaust is blocked or diverted horizontally or downward, an exit velocity of 0.001 meters per second should be input into the model so that a fictitious upward momentum is not credited to the source. If a stack is tilted from the vertical, the applicant may account for the vertical velocity of the plume by using trigonometric calculations where appropriate.

If the temperature of the release is near ambient, it may be appropriate to characterize the non-standard source as a volume or area source. If the temperature of the release is not near ambient, a virtual source could be created to represent the source. Non-standard point sources may have buoyancy or momentum that could be estimated to provide more realistic impacts.

Ohio EPA has provided a specific solution to address hot stack plumes that are impeded by a rain cap or which are released horizontally. It would be conservative only to reduce the exhaust velocity of the impeded stack. However, the source would lose the effect of the buoyancy that the volume of hot gas would normally have. Ohio EPA provides a recommended adjustment that provides for retention of the buoyancy while addressing the impediment to the vertical momentum of the release. The procedure is as follows:

- Set the actual stack velocity (V_{actual}) to an adjusted stack exit velocity ($V_{adjusted}$) of 0.001 meters per second

- Determine an adjusted stack diameter ($D_{adjusted}$) by adjusting the actual stack inside diameter (D_{actual}) to account for buoyancy of the plume by using the following equation:

$$D_{adjusted} = 31.6(D_{actual})(V_{actual})^{0.5}$$

- Use the adjusted parameters, $V_{adjusted}$ and $D_{adjusted}$ in the modeling analysis

In addition to the Ohio EPA method, the Texas Commission on Environmental Quality (TCEQ) provides another method to model pseudo point sources (TCEQ, 1999). The TCEQ approach is simpler and more conservative than the Ohio EPA approach since it does not account for buoyancy or momentum fluxes. If it is necessary to model emissions from fugitive sources, and if a pseudo-point characterization is appropriate, then the applicant could use following modeling parameters:

- Stack exit velocity = 0.001 meters per second

- Stack exit diameter = 0.001 meter

- Stack exit temperature = 0 Kelvin (causes the ISCST3 model to use the ambient temperature as the exit temperature)

- Actual release height

The Ohio EPA or Texas CEQ approaches may be taken to model non-standard, pseudo-point sources. It is suggested that the applicant provide ADEQ details regarding non-standard point sources for review prior to modeling.

3.3.8   *Emission Point Co-Location*
Regulatory modeling should reflect the actual characteristics of the proposed or existing emissions points at a facility. Therefore, emission points should not be co-located except in well-justified situations. For example, co-location may be appropriate when the number of emission points at a large facility exceeds the capability of the model. It is not acceptable to co-locate emission points merely for convenience or to reduce model run time. Co-locating emission points may be appropriate if individual emission points:

- Emit the same pollutant(s),

- Have the same source release parameters, and

- Are located within 100-meters of each other.

For very large emission sources such as power plants and copper smelters, ADEQ does not allow co-location of individual emission points since slight movements in the location of large emission points can significant impact modeling results for NAAQS, PSD increment, and visibility analyses.

It is suggested that the applicant provide ADEQ details regarding the possible co-location of emission points for review prior to modeling.

3.4   Process Area Boundary
ADEQ recognizes that ambient air begins at the process area boundary (PAB). The PAB policy has been developed by ADEQ to provide consistent treatment regarding ambient air for facilities in Arizona. Therefore, ADEQ does not recognize property boundaries, fencelines, or public access as the boundary between ambient air and the source. Permit applicants are required to demonstrate modeled compliance with standards and guidelines at receptors spaced along and outside the PAB.

The process area is the area in which those processes that directly constitute emission generating activity at a facility are operated and contained. The process area is to include only the immediate vicinity of the currently utilized portions of the property (e.g. quarries, stockpiles,

haul roads, work yards, and closely-related activity areas). Employee parking lots and offices are not considered part of the process area. Often times, this PAB is irregular in size and shape. Natural topographic boundaries can also create portions of the PAB.

Please refer to the policy, "Definition of Ambient Air and Areas Subject to Compliance With Ambient Air Quality Standards", in Appendix A. Determining the PAB is a somewhat subjective exercise involving input from both the applicant and ADEQ. Prior to performing the modeling analysis, the applicant should provide ADEQ a scaled facility plot plan or aerial photo clearly indicating a proposed PAB and associated areas of active portions of the facility's process. Modeling will not be accepted by ADEQ without the prior submittal and approval of a PAB map.

3.5   Modeling Coordinate Systems

Refined modeling should always be performed using Universal Transverse Mercator (UTM) coordinates. Please do not use coordinate systems based on plant coordinates. Always indicate the datum used for the UTM coordinates. There are several horizontal data coordinate systems (NAD27, WGS72, NAD83, and WGS84) that are used to represent locations on the earth's surface. Make sure that all of the coordinates are in the same horizontal datum when representing receptor, building, and source locations in UTM coordinates.

It is necessary to use UTM coordinates to be consistent with emission point locations provided on permit application forms and other reference materials such as USGS topographic maps.   In addition, ADEQ utilizes UTM information to check submitted modeling files against digital GIS mapping products.

3.6   Receptor Networks

Receptors should be placed throughout a modeling domain to determine areas of maximum predicted concentrations. The extent of receptor coverage around a facility is usually handled on a case-by-case basis since source dispersion characteristics, topography, and meteorological conditions differ from source to source. Table 3 indicates typical receptor spacing suggested by ADEQ for refined modeling analyses.

Table 3. Suggested Receptor Spacing

Type of Receptors	Suggested Receptor Spacing (meters)	Receptor Coverage Area
Tight	25	Along PAB
Fine	100	From PAB to 1 km
Medium	200 - 500	From 1 km to 5 km away from PAB
Coarse	500 - 1,000	From 5 km away from PAB out to 50 km
Discrete	Not Applicable	Place at areas of concern such as nearby residences, schools, worksites or daycare centers
Non-Attainment Area	Case-by-Case	Discuss with ADEQ prior to modeling
Class I and Class II Wilderness Area	Case-by-Case	Discuss with Federal Land Manager prior to modeling

Additional modeling should be conducted in the vicinity of each receptor when a predicted concentration exceeds 90% of an applicable standard or guideline. For example, use a tight grid with receptors spaced at 25 meters to fill in the fine, medium, or coarse receptors that indicate a

predicted concentration greater than 90% of an applicable standard or guideline. No further modeling is necessary if a predicted concentration greater than 90% of an applicable standard or guideline occurs at the facility's PAB.

Given the diverse topography of Arizona, most modeling domains include topography above stack height (i.e. complex terrain). Therefore, ADEQ typically requests that refined modeling be performed with elevations included for each receptor.

3.7   Rural/Urban Classification

It is necessary to classify the land use in the vicinity of emission sources since rates of dispersion differ between urban and rural areas. In general, urban areas cause greater rates of dispersion because of increased turbulent mixing and buoyancy-induced mixing. This mixing is due to the combination of greater surface roughness caused by more buildings and structures. In addition, urban areas also exhibit greater amounts of heat released from concrete and similar building materials.

EPA guidance identifies two procedures to make an urban or rural classification for dispersion modeling: the land-use procedure and the population density procedure. Both procedures require the evaluation of characteristics within a 3-kilometer radius from a facility. Of the two procedures, the land-use procedure is preferred. The land-use procedure specifies that the land-use within a three-kilometer radius of the source should be determined using the typing scheme developed by Auer (1978).

If the sum of land use types I1 (heavy industrial), I2 (light to moderate industrial), C1 (commercial), R2 (compact new residential), and R3 (compact old residential) is greater than or equal to 50% of the area within the circle, then the area should be classified as urban. Otherwise the area should be classified as rural. Table 4 indicates Auer's land-use categories.

Table 4. Auer Land-Use Classifications

Auer Type	Description	Urban or Rural?
I1	Heavy Industrial	Urban
I2	Light-Moderate Industrial	Urban
C1	Commercial	Urban
R1	Common Residential (normal easements)	Rural
R2	Compact Residential (single family)	Urban
R3	Compact Residential (multiple family)	Urban
R4	Estate Residential (multi-acre)	Rural
A1	Metropolitan Natural	Rural
A2	Agricultural Rural	Rural
A3	Undeveloped (grasses)	Rural
A4	Undeveloped (heavily wooded)	Rural
A5	Water Surfaces	Rural

3.8 Meteorological Data

ADEQ recognizes that the availability of meteorological data in Arizona is limited. EPA's Support Center for Regulatory Air Models (SCRAM) website, http://www.epa.gov/ttn/scram, provides some meteorological data for Arizona which can be used in dispersion models. National Weather Service surface data is collected at Phoenix, Prescott, Tucson, and Yuma. Upper-air data is available for Tucson. In some cases, ADEQ allows the use of upper-air data from Desert Rock, Nevada.

Given the complex topography of Arizona and the remote locations of many facilities from population centers, meteorological data from the SCRAM website is often not representative of meteorological conditions at many facilities. If on-site meteorological data is unavailable for a given facility and the applicant wishes to model using meteorological data available from another location, the applicant must submit a detailed meteorological analysis to ADEQ for review. The meteorological analysis should explain how meteorological data from an offsite location is representative of the meteorological patterns around the facility. The applicant should discuss the differences/similarities in topography and climatology (especially wind patterns and mixing heights) between the two locations. The applicant should also explain why the utilization of offsite meteorological data would provide conservative modeling results.

For PSD modeling analyses and for large sources, ADEQ often requires that applicants monitor one year of meteorological parameters from a representative on-site location. To generate a model-ready meteorological data set, the applicant merges monitored surface data with available upper-air data. **At the earliest stages of the air quality permitting process, it is important that the applicant communicate with ADEQ so that it can be determined whether or not meteorological monitoring will be necessary.** If meteorological monitoring is necessary, the monitoring should follow monitoring guidance and QA/QC guidance from USEPA. ADEQ relies upon the guidance provided in the document, *Meteorological Monitoring Guidance for Regulatory Modeling Applications (EPA, 2000).* ADEQ relies upon the QA/QC guidance provided in EPA's *Quality Assurance Handbook for Air Pollution Measurement Systems* (five volume set).

ADEQ has compiled a small library of ISCST3-ready meteorological data. Please contact ADEQ to determine if a representative meteorological data set is available for a particular location.

3.9 Background Concentrations

In Arizona, ambient monitoring is conducted by a number of governmental agencies and regulated industries. Each year, the AQD compiles an annual monitoring report that summarizes monitored values from around Arizona. The reports also list active monitoring networks for various criteria pollutants.

Electronic copies of the AQD's annual air quality reports (required by A.R.S. §49-424.10) can be downloaded from ADEQ's website at http://www.azdeq.gov/function/forms/reports.html. Currently, annual reports containing monitoring data for the years 2002-1999 are available online.

ADEQ suggests that permit applicants select the average of the highest monitored values from the most recent three years of available monitoring data for background concentrations in NAAQS modeling analyses for PM_{10}. For other criteria pollutants such as CO, SO_2, and NO_2, ADEQ suggests that permit applicants select the highest monitored values from the most recent three years of available monitoring data for background concentrations in NAAQS modeling analyses. Background concentrations should be representative of regional air quality in the vicinity of a facility. For more information, please refer to the *Guideline on Air Quality Models.*

In addition, ADEQ occasionally requires that applicants monitor one year of background data for particular criteria pollutants from a representative on-site location for PSD modeling analyses. At the earliest stages of the air quality permitting process, it is important that the applicant communicate with ADEQ so that it can be determined whether or not background monitoring will be necessary. If background monitoring is necessary, the monitoring should follow monitoring guidance and QA/QC guidance from EPA. ADEQ relies upon the monitoring guidance provided in the *Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD) (EPA 1987).* ADEQ relies upon the QA/QC guidance provided in EPA's *Quality Assurance Handbook for Air Pollution Measurement Systems* (five volume set).

3.10   Building Downwash and GEP Stack Height

Airflow over and around structures significantly impacts the dispersion of plumes from point sources. Modeling of point sources with stack heights that are less than good engineering practice (GEP) stack height should consider the impacts associated with building wake effects (also referred to as building downwash). Building downwash effects are not considered for non-point sources.

AAC R18-2-332 outlines stack height limitations. These limitations include a definition of GEP stack height. In the GEP definition, note that H_g = GEP stack height, H_b = height of nearby structure, and L = lesser dimension (height or projected width) of nearby structure.

GEP stack height is calculated as the highest of the following four numbers in subsections (1) through (4) below:

(1)   213.25 feet (65 meters),

(2)   For stacks in existence on January 12, 1979, and for which the owner of operator has obtained all applicable preconstruction permits of approvals required under 40 CFR 51 and 52 and AAC R18-2-403, $H_g = 2.5H_b$,

(3)   For all other stacks, $H_g = H_b + 1.5L$,

(4)   The height demonstrated by a fluid model or field study approved by the reviewing agency, which ensures that the emissions from a stack do not result in excessive concentrations of any air pollutant as a result of atmospheric downwash, wakes, or eddy effects created by the source itself, nearby structures, or nearby terrain obstacles.

When calculating pollutant impacts, the ISCST3 and ISC-PRIME models have the capability to account for building downwash produced by airflow over and around structures. In order to do so, the model requires special input data known as direction-specific building dimensions (DSBDs) for all stacks below the GEP stack height. Methods and procedures to determine the appropriate entries to account for downwash are discussed in EPA's *User's Guide to the Building Profile Input Program (EPA, 1995).*

Due to the complexity of the GEP guidance, the EPA has developed a computer program that calculates the downwash parameters for the ISCST3 and ISC-PRIME models. The Building Parameter Input Program (BPIP) must be used for downwash analyses for input to the ISCST3 model. BPIP-PRIME must be used for downwash analyses for input to the ISC-PRIME model. Use the most current version of these programs to determine downwash parameters. Currently, the BPIP and BPIP-PRIME can be downloaded from EPA's Support Center for Regulatory Air Models (SCRAM) website at http://www.epa.gov/ttn/scram.

To account for downwash in the SCREEN3 model, it is necessary to enter a building or structure height and the respective maximum and minimum horizontal dimensions. Generally, include the building with the dimensions that result in the highest GEP stack height for that source, to evaluate the greatest downwash effects.

3.11   Modeling for NO_2

Typically, emission calculations and modeling are performed for nitrogen oxides (NOx). However, the NAAQS and PSD increments are for nitrogen dioxide (NO_2). The *Guideline on Air Quality Models* provides a multi-tiered screening approach for estimating annual NO_2 concentrations from point sources.

For Tier 1, assume total conversion of NO to NO_2. If the concentration from Tier 1 exceeds the NAAQS and/or PSD increments for NO_2 proceed to Tier 2.

For Tier 2, multiply the annual NOx estimate by an empirically derived ambient NO_2/NOx value of 0.75 which is the national annual default. Note that ambient NO_2/NOx ratios are calculated from ambient monitoring data. If a representative monitoring site can be found (e.g. Palo Verde for rural areas), an alternative NO_2/NOx ratio can be utilized. Unless approved by ADEQ in advance, alternative ambient NO_2/NOx ratios should not be used in lieu of the national annual default value of 0.75. If the concentration from Tier 2 exceeds the NAAQS and/or PSD increments for NO_2 proceed to Tier 3.

For Tier 3, a detailed screening method may be selected on a case-by-case basis. For point source modeling, other refined screening methods, such as the ozone limiting method (OLM), may also be considered. Also, a site specific ambient NO_2/NOx ratio may be used. Case-by-case methods including the OLM should not be used unless approved by ADEQ in advance.

4.0 ADEQ PERMITTING JURISDICTION AND CLASSIFICATIONS

4.1 Air Quality Permitting Jurisdiction in Arizona

Of Arizona's 15 counties, the State has delegated the regulation of air pollution to three counties. These three counties (Maricopa, Pinal, and Pima) oversee their own air quality regulation. ADEQ has jurisdiction in the other 12 counties. These permitting authorities should be consulted directly for proposed projects in their counties:

- Maricopa County (http://www.maricopa.gov/envsvc/airqual.asp)
- Pima County (http://www.deq.co.pima.az.us/air/index.htm)
- Pinal County (http://www.co.pinal.az.us/AirQual/)

Figure 1 provides map of counties, major highways, and selected towns and cities in Arizona.

Figure 1. Map of Arizona
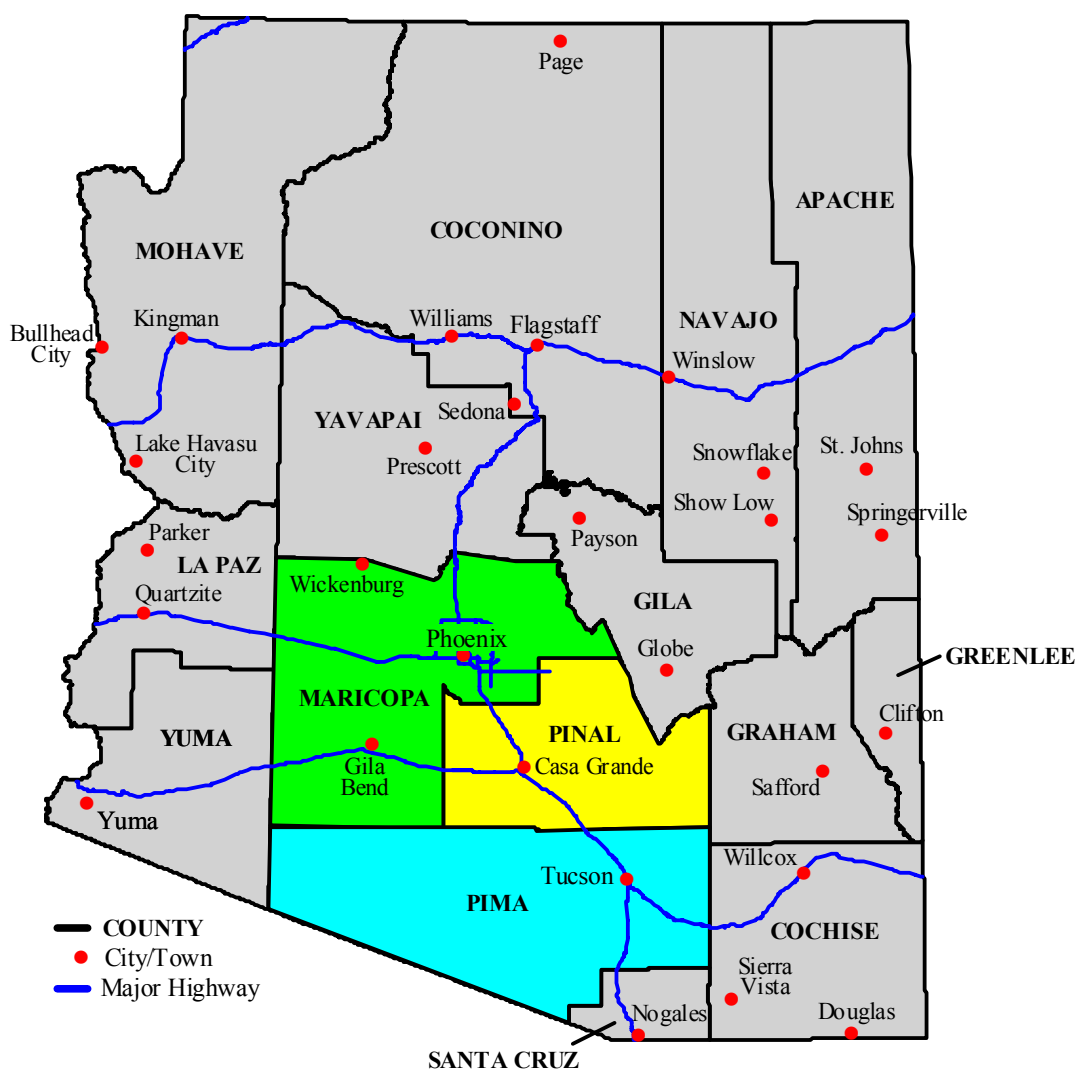
Portable sources may be permitted by ADEQ for operations in Arizona that are outside of Maricopa, Pinal, and Pima counties. Portable sources may be permitted by both ADEQ and/or Maricopa, Pinal, and Pima counties if the source will reside for any length of time in these three counties.

EPA Region 9 (http://www.epa.gov/region09/air/) is involved in the review of ADEQ-issued permits, such as Title V and PSD (i.e. major source) air permits. In addition, Federal Land Managers (FLMs) have jurisdiction over Class I areas (see Section 6.3.4). FLMs have the responsibility for reviewing and providing comments on air quality impacts inside Class I areas.

Most Native American Reservations are under the jurisdiction of the federal Environmental Protection Agency. Some tribes in Arizona have their own air pollution control programs. More information regarding tribal programs can be found at:

- Gila River Indian Community (http://www.gric.nsn.us/)
- Fort McDowell Yavapai Nation (http://www.ftmcdowell.org/)
- Navajo Nation (http://www.navajo.org/)
- Salt River Pima-Maricopa Indian Community (http://www.saltriver.pima-maricopa.nsn.us/)

Additional information regarding many of Arizona's tribes is available through the Intertribal Council of Arizona (http://www.itcaonline.com/).

Figure 2 displays the locations of tribal lands located in Arizona.

Figure 2. Tribal Lands in Arizona
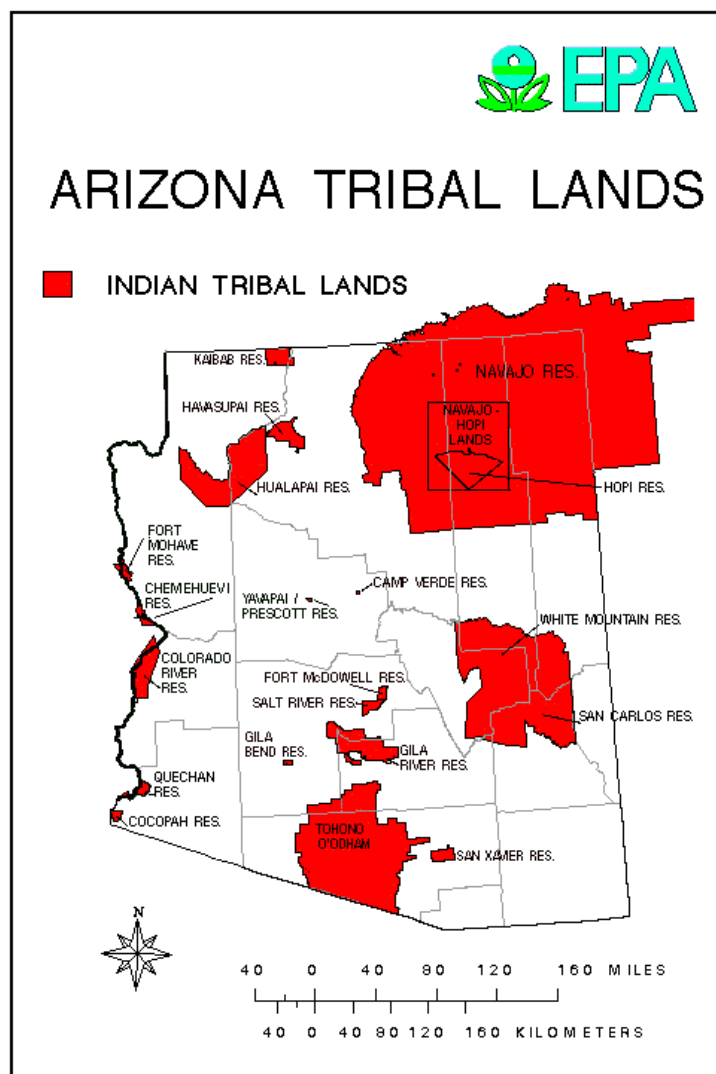
4.2   Main ADEQ Permit Classifications

ADEQ handles modeling for both state and federal air quality permits. ADEQ refers to permits for minor sources as Class II permits. Major source permits are referred to as Class I permits. Modeling analyses may be required by ADEQ for the following permit types listed in Table 5.

Table 5. Main ADEQ Permit Classifications

Permit Action [1]	Permit Classification
New Permit	New Class I - Subject to PSD
New Permit	New Class I - Not Subject to PSD
New Permit	New Class II
Minor Permit Revision	Any Existing Source
Significant Permit Revision	Existing Class I - Subject to PSD
Significant Permit Revision	Existing Class I - Not Subject to PSD
Significant Permit Revision	Existing Class II - Subject to PSD
Significant Permit Revision	Existing Class II - Not Subject to PSD
Permit Renewal	Existing Class I
Permit Renewal	Existing Class II
New or Existing Permit	Portable Source
N/A	General Permit

[1] See A.A.C. R18-2-317 through R18-2-324 regarding ADEQ's air permit classifications

ADEQ reserves the right to make adjustments to the modeling requirements of each permit on a case-by-case, pollutant-specific basis. In addition, modeling may be required for other types of permitted sources not listed in Table 5. Recall that dispersion modeling is required to demonstrate that a new facility or a new project at an existing facility will not adversely impact public health and welfare. ADEQ believes that this demonstration is necessary for facilities of various configurations and sizes regardless of permit classification.

5.0   ADEQ MODELING REQUIREMENTS FOR NON-PSD SOURCES

For non-PSD sources, ADEQ requires that applicants model criteria pollutant impacts for comparison to the NAAQS. In addition, ADEQ requires that applicants model various toxic air pollutants for comparison to the Arizona Ambient Air Quality Guidelines (AAAQGs). Please see Section 5.1 for more information on non-PSD NAAQS modeling. Please see Section 5.2 for more information on AAAQG modeling.

5.1   Non-PSD NAAQS Analyses

For non-PSD sources, representative background concentrations (see Section 3.9) should be added to modeled impacts from the applicant's facility. Unlike the methods used in NAAQS analyses for PSD permit applications, inclusion of regional sources in the non-PSD NAAQS is typically not required. However, on a case-by-case basis, ADEQ reserves the right to request modeling which includes the non-PSD source in question and additional nearby or regional sources.

5.2   AAAQG Analyses For Non-PSD Sources

In 1992, the Arizona Department of Health Services (ADHS) established the Arizona Ambient Air Quality Guideline (AAAQG) values for various toxic air pollutants. ADHS revised the AAAQG values in 1999. However, ADEQ currently requires sources to demonstrate that the maximum modeled offsite impacts are less than the values listed in the July 15, 1992 AAAQG list (see Appendix B). Note that the methods, equations, and assumptions used to develop the 1999 AAAQG list are identical to those used to develop the 1992 list.

AAAQGs are screening values that are protective of human health, including children. AAAQGs have been developed for 1-hour, 24-hour, and annual averaging periods. Chemical concentrations in the air that exceed AAAQGs may not necessarily represent a health risk. Rather, when contaminant concentrations exceed these guidelines, further evaluation may be necessary to determine whether there is a true threat to human health. It is not intended for AAAQGs to be used as standards. Rather, they are intended to provide health-based guidelines that may be useful in making environmental risk management decisions.

Preliminary modeling of a source may indicate that predicted impacts exceed the AAAQG value for a particular toxic air pollutant. If an AAAQG is initially exceeded, it is the responsibility of the applicant to consider several options to limit the AAAQG exceedance. The preliminary AAAQG exceedances might be reduced by:

- Refining emissions estimates by using other, defensible emission factors than those used in the preliminary modeling analysis,

- Limiting operational hours or process throughputs,

- Optimizing stack parameters for better pollutant dispersion (i.e. raise stack heights, increase exhaust airflows, or crown stack diameters to obtain higher exhaust velocities),

- Relocating sources to other portions of a facility which would lead to lower modeled impacts,

- Source testing to refine emissions estimates,

- Installing pollution controls to limit emissions.

6.0   ADEQ MODELING REQUIREMENTS FOR PSD SOURCES

This section presents ADEQ modeling requirements and guidance regarding PSD triggering pollutants, non-PSD criteria pollutants, and AAAQG pollutants emitted from a source that is required to obtain a PSD air quality permit.

6.1   NAAQS Analyses for Pollutants That Do Not Trigger PSD
For criteria pollutants at a PSD source that do not trigger PSD requirements, representative background concentrations (see Section 3.9) should be added to modeled impacts from the applicant's facility only. Inclusion of regional sources in the NAAQS analysis for a pollutant that does not trigger PSD is typically not required.

6.2   AAAQG Analyses For PSD Sources
ADEQ requires that PSD applicants model various toxic air pollutants for comparison to the Arizona Ambient Air Quality Guidelines (AAAQGs). Please see Section 5.2 for more information on AAAQG modeling.

6.3   Overview of PSD Modeling Procedures
For PSD triggering pollutants, ADEQ requires that applicants follow EPA's *New Source Review Workshop Manual (EPA, 1990)* and other applicable PSD guidance set forth in the EPA's *Guideline on Air Quality Models* to complete the air quality impact analysis. The *New Source Review Workshop Manual* (see Chapters C, D, and E) provides a good overview and examples of modeling analyses required for sources that trigger PSD.

The PSD modeling analysis is performed in two steps: a preliminary analysis (often referred to as a significant impact analysis), and if required, a full impact analysis. The preliminary analysis estimates ambient concentrations resulting from the proposed project for pollutants that trigger PSD requirements. For this analysis, a loads analysis should be performed to determine that project impacts are not underestimated.

The results of the preliminary analysis determine whether an applicant must perform a full impact analysis for a particular pollutant. If the ambient impacts from the preliminary analysis are greater than the PSD Significant Impact Levels (SILs, see Table 6), then the extent of the Significant Impact Area (SIA) of the proposed project is determined. Initially, the SIA is determined for every relevant averaging time for a particular pollutant. The final SIA for that pollutant is the largest area for each of the various averaging times. The preliminary, facility-only impact analysis involves modeling impacts for comparison to both the PSD Class II Significant Impact Levels and Significant Monitoring Concentration Levels as shown in Table 6. Pre-application air quality monitoring is necessary if the facility-only impacts exceed the Significant Monitoring Concentration Levels.

Table 6. Ambient Air Quality Standards and Levels

Pollutant	NO$_2$ (µg/m^3) Annual	CO (µg/m^3) 1-hour	CO (µg/m^3) 8-hour	PM$_{10}$ (µg/m^3) 24-hour	PM$_{10}$ (µg/m^3) Annual	SO$_2$ (µg/m^3) 3-hour	SO$_2$ (µg/m^3) 24 hour	SO$_2$ (µg/m^3) Annual
PSD Class II Significant Impact Level (SIL)	1	2,000	500	5	1	25	5	1
Significant Monitoring Conc. Level	14	---	575	10	---	---	13	---
NAAQS	100	40,000	10,000	150	50	1,300	365	80
PSD Class II Increment Level	25	---	---	30	17	512	91	20
PSD Class I Increment Level	2.5	---	---	8	4	25	5	2

The full impact analysis expands the preliminary impact analysis by considering emissions from both the proposed project as well as other sources in the SIA. The full impact analysis may also consider other sources outside the SIA that could cause significant impacts in the SIA of the proposed source. The results from the full impact analysis are used to demonstrate compliance with NAAQS and PSD increments. The source inventory for the cumulative NAAQS analysis includes all nearby sources that have significant impacts within the proposed source SIA, while the source inventory for the cumulative PSD increment analysis is limited to increment-effecting sources (new sources and changes to existing sources that have occurred since the applicable increment baseline date).

The full impact analysis is limited to receptor locations within the proposed project's SIA. The modeling results from the NAAQS cumulative impact analysis are added to representative ambient background concentrations and the total concentrations are compared to the NAAQS. Conversely, the modeled air quality impacts for all increment-consuming sources are directly compared to the PSD increments to determine compliance (without consideration of ambient background concentrations).

6.3.1 NAAQS Modeling Inventory
In addition to modeling the proposed source and adding background values, EPA requires that, at a minimum, all nearby sources be explicitly modeled as part of the full NAAQS analysis for PSD. The *Guideline on Air Quality Models* defines a nearby source as any point source expected to cause a significant concentration gradient in the vicinity of the proposed new source or modification. For PSD purposes, vicinity is defined as the significant impact area (SIA) for each pollutant. However, the location of such nearby sources could be anywhere within the significant impact area or an annular area extending 50 kilometers beyond the SIA.

For the full NAAQS modeling analyses, all permitted sources within the SIA must be explicitly modeled. In addition, all permitted sources located outside the SIA and within the annular area extending 50 km from the SIA must also be included if they have potential to affect air quality near the proposed source.

Whether to include a regional source can be determined using the '20D' approach (also followed by Ohio EPA), also known as the North Carolina Protocol. The '20D' approach assumes a linear inverse proportional relationship between source emissions and impacts with distance. A '20D' facility-level screening approach is used to eliminate a majority of regional facilities from the

PSD NAAQS modeling analysis that would not be expected to have a significant impact on analysis results. Under this approach, the applicant may exclude sources that have potential allowable emissions (Q) in tons/yr that are less than 20 times the distance ('20D') between the two sources in kilometers. Those sources that are not eliminated using the '20D' approach should be modeled in the full NAAQS analysis.

The ADEQ Compliance Section provides regional source emission inventories to permit applicants. The Compliance Section can be reached at 602-771-2273.

6.3.2   Increment Modeling Inventory

A PSD increment is the maximum allowable increase in concentration that is allowed to occur above a baseline concentration for a pollutant. The baseline concentration is defined for each pollutant (and relevant averaging time) and, in general, is the ambient concentration existing at the time that the first complete PSD permit application affecting an area is submitted. Significant deterioration is said to occur when the amount of new pollution would exceed the applicable PSD increment.

According to PSD Guidelines, the increment inventory to be considered in the modeling analysis includes all increment-affecting sources located within the SIA of the proposed new source or modification. In addition, all increment-affecting sources located within 50 kilometers of the SIA should also be included in the inventory if they, either individually or collectively, affect the amount of PSD increment consumed.

In general, the stationary sources of concern for the increment inventory are those stationary sources with actual emissions changes occurring since the <u>minor</u> source baseline date. However, it should be noted that certain actual emissions changes occurring before the minor source baseline date (i.e. at major stationary point sources) also affect the increments. To clarify, the types of stationary point sources that should be initially reviewed to determine the need to include them in the increment inventory fall under two specific time frames:

I) After the major source baseline date:
- Existing <u>major</u> stationary sources having undergone a physical change or change in their method of operation
- New <u>major</u> stationary sources

II) After the minor source baseline date:
- Existing stationary sources having undergone a physical change or change in their method of operation
- Existing stationary sources having increased hours of operation or capacity utilization (unless such change was considered representative of baseline operating conditions)

The *New Source Review Workshop Manual (EPA, 1990)* provides details regarding the major source baseline date, trigger date, and minor source baseline dates. The major source baseline date and trigger dates are fixed. The major source baseline dates are: January 6, 1975 for PM, January 6, 1975 for SO_2, and February 8, 1988 for NO_2. The trigger dates are: August 7, 1977 for PM, August 7, 1977 for SO_2, and February 8, 1988 for NO_2.

In contrast, the minor source baseline dates vary for each of Arizona air quality control region (AQCR). The minor source baseline date is the earliest date after the trigger date on which a complete PSD application is received by the permit-reviewing agency. The minor source

baseline dates vary for each AQCR in Arizona. Table 7 presents the minor source baseline date for Arizona's six AQCRs. Figure 3 displays the AQCRs in Arizona.

Table 7. Minor Source Baseline Dates for Arizona AQCRs

Air Quality Control Region (AQCR)	Counties Included In AQCR	Minor Source Baseline Dates		
		PM	SO$_2$	NO$_2$
Central Arizona Intrastate	Gila, Pinal	February 1, 1979	April 18, 1988	April 26, 1996
Maricopa Intrastate	Maricopa	March 3, 1980	March 3, 1980	January 20, 1993
Northern Arizona Intrastate	Apache, Coconino, Navajo, Yavapai	October 31, 1977	October 31, 1977	August 15, 1990
Pima Intrastate	Pima	not triggered	not triggered	not triggered
Southeast Arizona Intrastate	Cochise, Graham, Greenlee, Santa Cruz	April 5, 2002	April 5, 2002	April 5, 2002
Mohave-Yuma Intrastate	La Paz, Mohave, Yuma	July 15, 1998	March 15, 1999	April 10, 1991

Figure 3. Air Quality Control Regions in Arizona
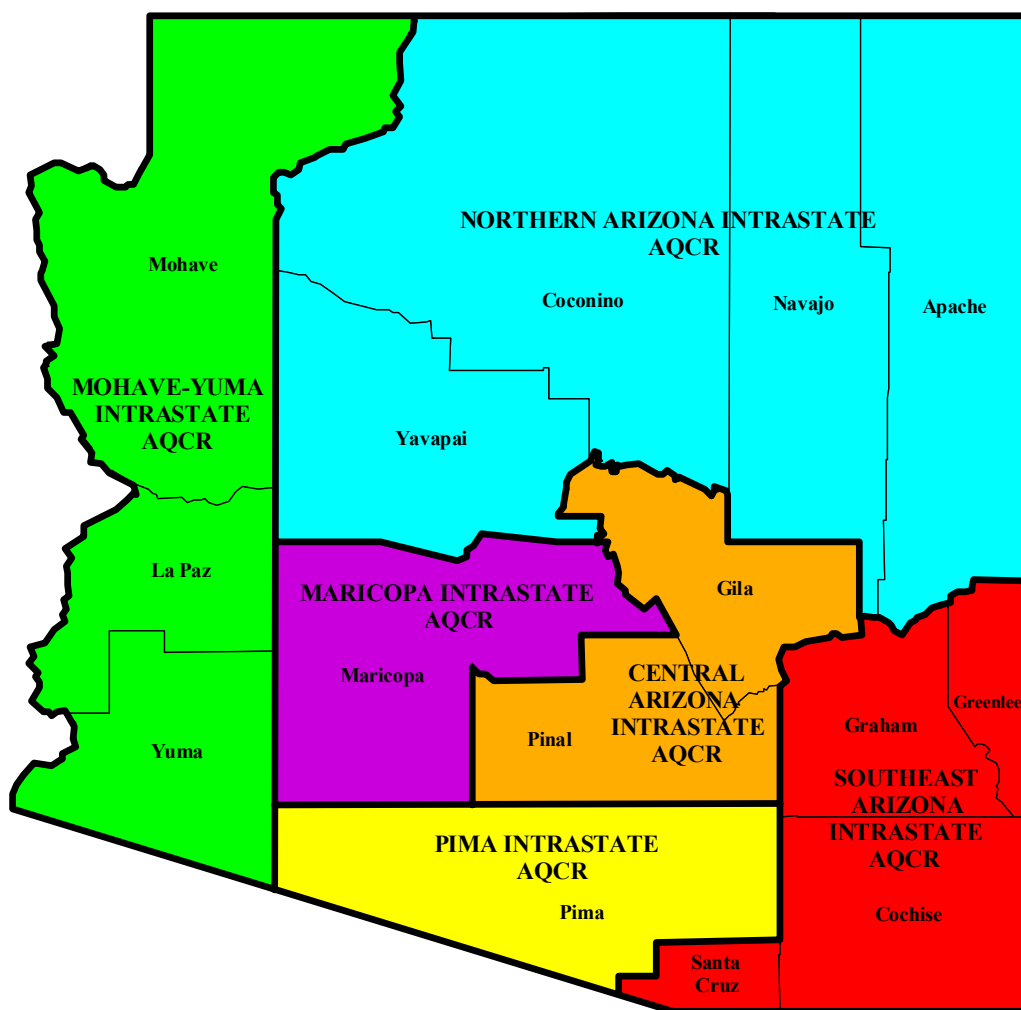
6.3.3   Additional Impact Analyses

PSD permit applicants must prepare additional impact analyses for each PSD triggering pollutant. These additional analyses assess the impacts of air, ground, and water pollution on soils, vegetation, and visibility caused by any increase in emissions of any regulated pollutant from the source or modification under review, and from associated growth. Details regarding these analyses can be found in Chapter D of the *New Source Review Workshop Manual (EPA, 1990)*.

6.3.4   Class I Area Impact Analyses

The Federal Land Managers' Air Quality Related Values Work Group (FLAG) was formed to develop a more consistent approach for the Federal Land Managers (FLMs) to evaluate air pollution effects on their resources. Of particular importance is the New Source Review (NSR) program and the review of PSD air quality permit applications. FLAG's goals are to provide consistent policies and processes for identifying air quality related values (AQRVs) and for evaluating the effect of air pollution on AQRVs, primarily those in Federal Class I air quality areas, but in some instances, in Class II areas. Federal Class I areas are defined in the Clean Air Act as national parks over 6,000 acres and wilderness areas and memorial parks over 5,000 acres that were established as of 1977. All other federally managed areas are designated as Class II.

40 CFR 51.307 requires the operator of any new major stationary source or major modification located within 100 kilometers of a Class I area to contact the FLM for that area. The FLM may request that the permit applicant model impacts on Class I areas further than 100 kilometers from the source.

The FLM review of a PSD permit application for a proposed project that may impact a Class I area consists of three main analyses:

- An air quality impact analysis to ensure that the predicted pollutant levels in Class I areas do not exceed the NAAQS or PSD increments,

- Air Quality Related Value (AQRV) impact analysis to ensure that the Class I area resources (i.e. visibility, flora, fauna, etc.) are not adversely affected by the proposed emissions, and

- Best Available Control Technology (BACT) analysis to help ensure that the source installs the best control technology to minimize emission increases from the proposed project.

During the PSD permitting process, the permit applicant should work closely with the FLM. Ultimately, the FLM (not ADEQ) has the responsibility for reviewing and providing comments on air quality impacts inside Class I areas. Table 8 lists the name of each Class I area located in Arizona and the managing agency responsible for each Class I area.

Table 8. Class I Areas Located in Arizona

Class I Area	Managing Agency
National Parks	
Grand Canyon	National Park Service
Petrified Forest	National Park Service

Table 8. Class I Areas Located in Arizona, contd.

Class I Area	Managing Agency
National Wilderness Areas	
Chiricahua National Monument	National Park Service
Chiricahua	Forest Service
Galiuro	Forest Service
Mazatzal	Forest Service
Mt. Baldy	Forest Service
Pine Mountain	Forest Service
Saguaro National Monument	National Park Service
Sierra Ancha	Forest Service
Superstition	Forest Service
Sycamore Canyon	Forest Service

Figure 4 shows the locations of Class I areas in Arizona.

Figure 4. Class I Areas in Arizona
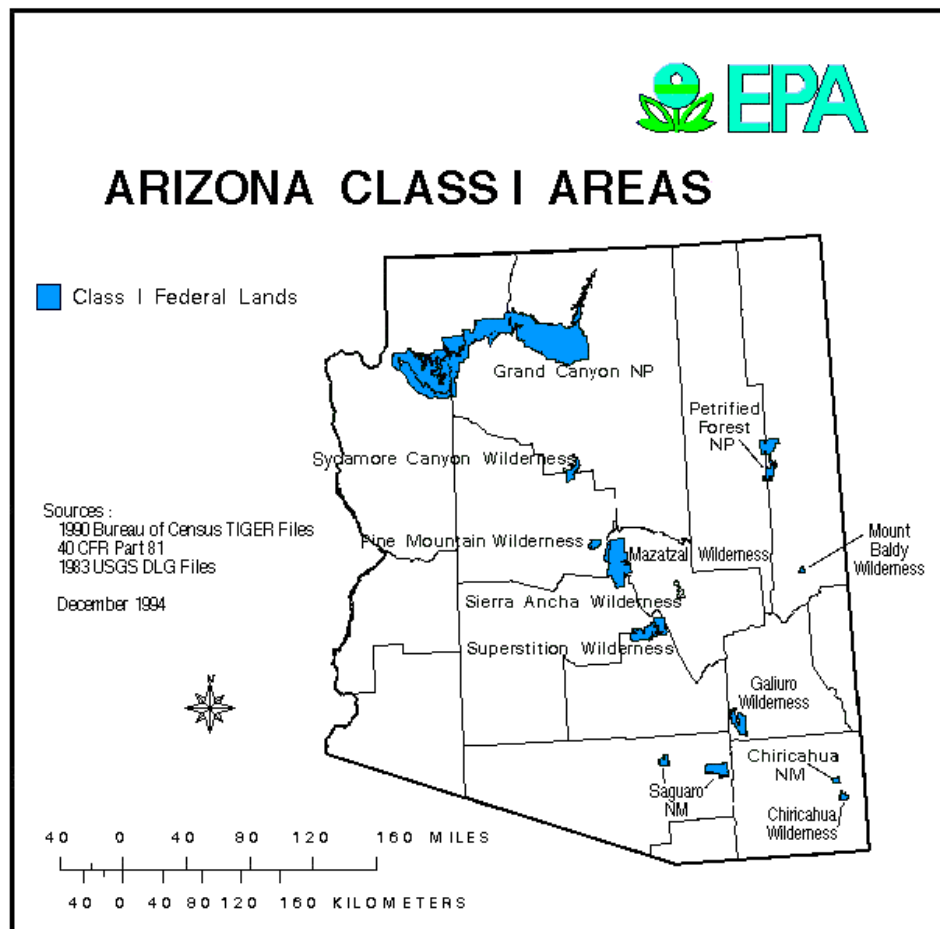
7.0   MODELING OF OPEN BURNING/OPEN DETONATION SOURCES

ADEQ has permitted sources with open burning and open detonation (OB/OD) operations regulated under both RCRA and the Clean Air Act. Steady-state Gaussian models are not appropriate for OB/OD operations which are typically not steady-state. Releases from OB/OD operations occur on much shorter time scales than one hour which is the minimum time step in many Gaussian models. Open detonation releases are usually quasi-instantaneous while open burning operations may occur on the time scale of seconds to hours. Therefore, ADEQ requests that OB/OD facilities applicants use appropriate models such as the OBODM model or other approved "puff" models to perform NAAQS and AAAQG modeling assessments.

ADEQ prefers the use of the OBODM model which EPA lists as an alternative air quality model. EPA's alternative air quality models are justified for use on a case-by-case basis for individual regulatory applications. OBODM (Open Burn/Open Detonation Model) is intended for use in evaluating the potential air quality impacts of the open burning and detonation (OB/OD) of obsolete munitions and solid propellants. OBODM uses cloud/plume rise dispersion, and deposition algorithms taken from existing models for instantaneous and quasi-continuous sources to predict the downwind transport and dispersion of pollutants released by OB/OD operations.

Given prior approval by both ADEQ and EPA, applicants may also use other alternative models to simulate OB/OD operations.

8.0 REFERENCES

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APPENDIX A

ADEQ SPECIFIC MODELING POLICIES

AMBIENT AIR POLICY

0131.000   DEFINITION OF AMBIENT AIR AND AREAS SUBJECT TO COMPLIANCE WITH AMBIENT AIR QUALITY STANDARDS

Level Two   Air Quality Division
                     Substantive Policy

Originator: Nancy C. Wrona
                     Director, Air Quality Division

**Contact for
Information:**   Gary Neuroth

Issue Date: June 18, 1997

PURPOSE

A clear understanding of the geographic limits of the "ambient air" is necessary for protection of public health and air quality compliance determinations. In practice, compliance with the National Ambient Air Quality Standards (NAAQS) is determined by either measuring air quality (monitoring) or performing computer simulations of air pollutant dispersion (modeling). A policy which defines the geographical extent of ambient air for monitor placement as well as establishing modeling domains for NAAQS compliance is needed for consistent application of air quality regulations throughout the State.

AUTHORITY

The NAAQS contained in Title 18 of the Arizona Administrative Code (AAC) were adopted by ADEQ as Arizona's ambient air quality standards in accordance with statutory authority under 49-424, "Duties of department The department shall: . . . 4. Determine the standards for the quality of the ambient air and the limits of air contaminants necessary to protect the public health . . ."

DEFINITIONS

"Ambient air" is defined in Title 18-2-101.12 of the AAC as follows: " 'Ambient air' means that portion of the atmosphere, external to buildings, to which the general public has access."

POLICY

For purposes of determining compliance with the NAAQS, consideration is limited to measured or modeled concentrations in ambient air that is within fifteen (15) meters of the earth's surface at any point. The specific heights within this layer for each pollutant or specific dispersion model are based on current applicable U.S. Environmental Protection Agency (EPA) regulations and technical guidance documents.

It is recognized that outdoor settings exist where determination

of compliance with the NAAQS based on EPA modeling and monitoring guidance is inappropriate and/or impractical due to safety or operational factors. (For example, consider roadway medians, airport runways, concert/rodeo arenas, sports stadia, prison yards and other "in use" areas to which members of the general public have access.) In certain outdoor workplace environments, specifically-defined portions of locations such as active construction sites and/or outdoor commercial, manufacturing or industrial process areas, the protection of public health relative to air contamination is governed and defined by federal Occupational Health and Safety Administration (OSHA) and/or Industrial Commission of Arizona (ICA) workplace regulations and standards.

Outdoor portions of active process areas of air contaminant sources subject to ADEQ emission control permits, also covered by OSHA and/or ICA air quality regulations, are not considered ambient air for purposes of determining compliance with the NAAQS by ADEQ. But the process area exempted from NAAQS compliance is to include only the immediate vicinity of the currently utilized portions of the property, e.g., quarries, stockpiles, haul roads, work yards and closely-related activity areas. The air over adjacent property, regardless of ownership, is considered "ambient." The determination of a "process area" boundary will be made by technical staff at ADEQ in consultation with the permittee on a case-by-case basis. With the limitations given above, the remaining outdoor atmosphere over Arizona, within ADEQ's jurisdiction, is considered ambient air.

This policy, although previously unwritten, has been in effect at ADEQ and its predecessor organizations since the late 1970's. It has provided a uniform level of public health and environmental protection to the general public, as well as reasonable and consistent requirements for the regulated community. The policy effectively recognizes that ADEQ does not regulate, or in any way control, atmospheric air movement, or access by members of the general public to areas with variable levels of air contamination, land ownership, land use or zoning. Therefore, ADEQ has no basis to exempt any members of the general public from the uniform level of environmental protection provided by the NAAQS. As described above, the policy provides a uniform level of ambient air quality protection within ADEQ's jurisdiction.

RESPONSIBILITY

This policy is applied by the Air Quality Division (AQD) of ADEQ in compliance with federal and state statutes and administrative rules, augmented by EPA technical guidance documents. Specifically, the AQD uses this policy to conduct air quality monitoring and modeling which determines and assures compliance with the NAAQS. When a violation of a NAAQS is monitored or modeled, corrective actions and/or State Implementation Plans are prepared and implemented to achieve compliance with the NAAQS.

0131.000 DEFINITION OF AMBIENT AIR AND AREAS SUBJECT TO
          COMPLIANCE WITH AMBIENT AIR QUALITY STANDARDS

Level Two   Air Quality Division
                   Substantive Policy

Originator: Nancy C. Wrona
                   Director, Air Quality Division
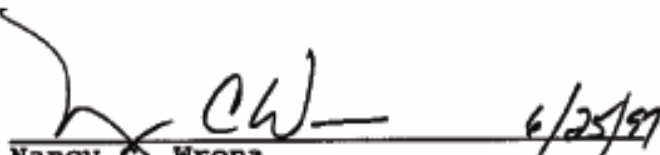
Contact for
Information: Gary Neuroth

Issue Date: June 18, 1997

                        APPROVED BY:

Level Two
Air Quality Division

Russell F. Rhoades   7/2/97
Director, ADEQ   Date

Nancy C. Wrona,   6/25/97
Director   Date
Air Quality Division

Mark R. Santana,   6/25/95
Administrative Counsel   Date
Office of the Administrative Counsel

The Policy Review Committee has posted, reviewed, and accepted
this policy by motion as of June 18, 1997.

Susan Bentley-Johnston   6·23·97
Susan Bentley-Johnston   Date
Recording Secretary

ARIZONA AMBIENT AIR QUALITY GUIDELINES (AAAQGs)

Originator: ADEQ Evaluation Unit
Date: June 1992, June 2003

It is ADEQ policy that new and modified sources will generally be required to meet the AAAQG values subject to a risk management review. Sources required to perform an AAAQG analysis include: major stationary sources (Class I), minor stationary sources (Class II), and portable sources.

ADEQ utilizes the AAAQG values (July 15, 1992 listing) to evaluate the ambient impacts of hazardous air pollutants. ADEQ typically requires that new and modified sources do not exceed the AAAQGs for short-term averaging periods (i.e. 1-hour and 24-hour).

In the event that a source exceeds the annual AAAQGs, the source must consider both emissions controls and stack configuration optimizations (e.g. stack height increases, stack diameter crowning, airflow increases, temperature increases, etc.) to reduce the modeled AAAQG exceedance. If the source has thoroughly considered these options and the annual AAAQG is still exceeded, ADEQ requests that the source explain (in writing) all the steps taken to minimize the exceedance. It is also suggested that the source provide ADEQ the annual modeled concentrations at the residences and worksites closest the source for use in a risk management decision.

Risk management decisions for AAAQG exceedances will be made by ADEQ's Air Quality Division Director. Revisions to the AAAQG list or risk management decisions altering the concentration of the AAAQG listed pollutant will be limited to the decisions made by the Arizona Department of Health Services (ADHS).

Originator: Nancy Wrona, Director, Air Quality Division
Date: November 1993

"…Since it will likely be some time before we are able to work through disagreements on major issues, the purpose of this memo is to advise you that we will continue to use our existing HAPs program relying on AAAQGs with existing *de minimus* levels until the new rules are adopted.

We have clear legal authority to do this. SB 1430 included session law that stated that nothing in the bill was intended to reduce the Director's authority to carry out programs in place at the time the bill was enacted. That provision was to ensure that sources would not be deregulated if the time for the development of the new program was protracted."

APPENDIX B

ARIZONA AMBIENT AIR QUALITY GUIDELINES (AAAQGs) LIST
July 15, 1992

Pollutant	CAS#	AAAQG Value (μg/m^3) [1]		
		1-Hour	24-Hour	Annual
Acetaldehyde	75-07-0	2.30E+03	1.40E+03	5.00E-01
Acetic Acid	64-19-7	5.63E+02	1.88E+02	---
Acetone	67-64-1	2.00E+04	1.40E+04	---
Acetonitrile	75-05-8	8.80E+02	5.60E+02	---
Acetophenone	98-86-2	1.50E+02	4.00E+01	---
Acrolein	107-02-8	6.70E+00	2.00E+00	---
Acrylamide	79-06-1	5.00E+00	2.40E-01	1.30E-03
Acrylic Acid	79-10-7	9.00E+02	2.40E+02	---
Acrylonitrile	107-13-1	2.10E+01	5.50E+00	1.50E-02
Aldrin	309-00-2	3.80E-01	1.00E-01	2.80E-04
Aliphatic Naptha	8030-30-6	---	2.60E+03	---
Allyl Alcohol	107-18-6	8.30E+01	4.00E+01	---
Aluminum Oxide	1344-28-1	4.50E+02	1.50E+02	---
Ammonia	7664-41-7	---	1.40E+02	---
Aniline	62-53-3	1.70E+02	6.60E+01	1.80E-01
Antimony	7446-36-0	1.50E+01	4.00E+00	---
Arsenic	7440-38-2	2.80E-01	7.30E-02	2.00E-04
Arsenic Pentoxide	1303-28-2	2.80E-01	7.30E-02	2.00E-04
Arsenic Trioxide	1327-53-3	2.80E-01	7.30E-02	2.00E-04
Arsine	7784-42-1	2.80E-01	7.30E-02	2.00E-04
Azinphos	86-50-0	5.00E+00	1.60E+00	---
1,3-Butadiene	106-99-0	7.20E+00	1.90E+00	6.70E-02
1-Butyl Acetate	123-86-4	---	5.30E+03	---
2-Butoxyethanol	111-76-2	3.60E+03	9.00E+02	---
Barium	7440-39-3	1.50E+01	4.00E+00	---
Barium Oxide	1304-28-5	1.50E+01	4.00E+00	---
Barium Sulfate (respirable fraction)	7727-43-7	1.50E+02	4.00E+01	---
Barium Sulfate (total dust)	7727-43-7	3.00E+02	8.00E+01	---
Benz(a)anthracene	56-55-3	7.90E-01	2.10E-01	5.70E-04
Benzene	71-43-2	6.30E+02	5.10E+01	1.40E-01
Benzidine	92-87-5	2.10E-01	5.50E-03	1.50E-05
Benzo(a)pyrene	50-32-8	7.90E-01	2.10E-01	5.70E-04
Benzyl Chloride	100-44-7	---	3.77E+01	1.20E+01
Beryllium	7440-41-7	6.00E-02	1.60E-02	5.00E-04
Bis(2-chloroethyl) Ether	111-44-4	3.80E+01	1.60E+00	4.30E-03
Bis(2-ethylhexyl) Phthalate	117-81-7	8.30E+01	4.00E+00	3.40E-01
Bis(chloromethyl) Ether	542-88-1	5.30E-04	1.40E-04	3.80E-07
Bismuth Oxide	1304-76-3	1.50E+02	4.00E+01	---
Borates	---	2.30E+01	7.50E+00	---

[1] AAAQG values from July 15, 1992 list

Pollutant	CAS#	AAAQG Value ($\mu g/m^3$) [1]		
		1-Hour	24-Hour	Annual
Boron	7440-42-8	2.30E+01	7.50E+00	---
Boron Oxide	1303-86-2	1.70E+02	8.00E+01	---
Boron Trichloride	10294-34-5	---	3.80E+01	---
Boron Triflouride	7637-07-2	---	2.30E+01	---
Bromodichloromethane	75-27-4	3.60E+01	9.50E+00	2.60E-02
Bromoform	75-25-2	1.50E+02	4.00E+01	---
Bromomethane (Methyl Bromide)	74-83-9	5.00E+02	1.60E+02	---
n-Butanol	71-36-3	3.80E+03	2.40E+03	---
n-Butyric Acid	107-92-6	3.00E+02	8.00E+01	---
2-Chloro-1,3-butadiene	126-99-8	1.10E+03	2.80E+02	---
3-Chloropropene	107-05-1	---	2.35E+01	---
Cadmium	7440-43-9	1.70E+00	1.10E-01	2.90E-04
Calcium Carbonate (respirable fraction)	1317-65-3	1.50E+02	4.00E+01	---
Calcium Carbonate (total dust)	1317-65-3	4.50E+02	1.20E+02	---
Calcium Fluoride	7789-74-5	7.60E+01	2.00E+01	---
Calcium Oxide	1305-78-3	1.50E+02	4.00E+01	---
Captan	133-06-2	1.20E+02	4.00E+01	1.00E+00
Carbaryl	63-25-2	8.00E+01	4.00E+01	---
Carbon Black	1333-86-4	---	2.60E+01	---
Carbon Disulfide	75-15-0	9.10E+01	2.40E+01	---
Carbon Tetrachloride	56-23-5	4.90E+01	1.30E+01	3.60E-02
Carbonyl Fluoride	353-50-4	1.20E+02	4.00E+01	---
Carbonyl Sulfide	463-58-1	1.20E+02	4.00E+01	---
Cellulose Nitrate (respirable fraction)	9004-70-0	1.50E+02	4.00E+01	---
Cellulose Nitrate (total dust)	9004-70-0	4.50E+02	1.20E+02	---
Chlorine	7782-50-5	6.90E+01	2.30E+01	---
Chlorobenzene	108-90-7	---	2.56E+03	---
Chlorodane	57-74-9	1.70E+01	1.10E+00	2.90E-03
Chloroform	67-66-3	6.00E+01	1.60E+01	4.30E-02
Chloromethane (Methyl Chloride)	74-87-3	3.60E+01	9.50E+00	2.60E-02
Chlorothalonil	1897-45-6	6.00E+01	1.60E+01	4.30E-02
Chromic Oxide	1333-82-0	1.50E+01	4.00E+00	---
Chromium	7440-47-3	1.10E+01	3.80E+00	---
Chromium VI	7440-47-3	1.10E-01	2.90E-02	8.00E-05
Copper (fume)	7440-50-8	2.30E+00	7.50E-01	---
Cresols	1319-77-3	6.40E+02	1.70E+02	---
Cupric Chloride	1344-67-8	2.30E+01	7.50E+00	---
Cupric Oxide	1317-38-0	3.00E+01	8.00E+00	---
Cuprous Chloride	7758-89-6	2.30E+01	7.50E+00	---
Cuprous Oxide	1317-39-1	3.00E+01	8.00E+00	---
1,1-Dichloroethane (Ethylidene Dichloride)	75-34-3	8.40E+03	3.20E+03	8.80E+00
1,1-Dichloroethene (Vinylidene Chloride)	75-35-4	4.20E+02	1.10E+02	3.00E+00

[1] AAAQG values from July 15, 1992 list

Pollutant	CAS#	AAAQG Value ($\mu g/m^3$) [1]		
		1-Hour	24-Hour	Annual
1,2-Dibromo-3-chloropropane	96-12-8	3.00E-01	7.90E-02	4.00E-03
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	9.10E-02	2.40E-02	6.70E-05
1,2-Dichlorobenzene	95-50-1	9.10E+03	2.40E+03	---
1,2-Dichloroethane	107-06-2	5.30E+01	1.40E+01	3.80E-02
1,2-Dichloroethene	156-59-2	2.38E+04	6.30E+03	---
1,2-Dichloropropane (Propylene Dichloride)	78-87-5	4.30E+03	2.80E+03	---
1,2-Diphenylhydrazine	122-66-7	9.10E+00	2.40E+00	6.70E-03
1,4-Dichlorobenzene	106-46-7	2.50E+02	6.60E+01	1.80E-01
1,4-Dioxane	123-91-1	3.00E+03	1.50E+02	4.00E-01
2,4-Dichlorophenol	120-83-2	6.00E+00	1.60E+00	---
2,4-Dinitrophenol	51-28-5	6.00E+00	1.60E+00	---
2,4-Dinitrotoluene	121-14-2	4.20E+01	5.50E+00	1.50E-02
DDD	72-54-8	2.50E+01	5.10E+00	1.40E-02
DDE	72-55-9	2.50E+01	5.10E+00	1.40E-02
Diacetone Alcohol	123-42-2	3.00E+03	1.90E+03	---
Diazinon	333-41-5	2.40E+00	8.00E-01	---
Dibenzo(a,h)anthracene	53-70-3	7.90E-01	2.10E-01	5.70E-04
Diborane	19287-45-7	---	7.50E-01	---
Dibromochloromethane	124-48-1	3.60E+01	9.50E+00	2.60E-02
Dichlorodifluoromethane	75-71-8	5.20E+04	3.90E+04	---
Dichlorodiphenyltrichloroethane [DDT]	50-29-3	2.50E+01	5.10E+00	1.40E-02
Dichloromethane (Methlyene Chloride)	75-09-2	7.60E+03	2.00E+03	5.60E+00
Dichlorosilane	4109-96-0	---	5.30E+00	---
Dicofol	115-32-2	9.00E+00	3.00E+00	8.00E-02
Dieldrin	60-57-1	4.20E-01	1.10E-01	2.90E-04
Diethyl Phthalate	84-66-2	8.30E+01	4.00E+01	---
Diethyl Telluride	627-54-3	---	7.50E-01	---
Diethylene Glycol, Monobutyl Ether	112-34-5	4.90E+02	1.30E+02	---
Diethylene Glycol, Monobutyl Ether Acetate	124-17-4	7.20E+02	1.90E+02	---
Diethylene Triamine	111-40-0	8.00E+01	3.00E+01	---
Dimethoate	60-51-5	3.00E-01	1.00E-01	---
Dimethylnitrosoamine (n-Nitrosodimethylamine)	62-75-9	2.50E-01	6.60E-02	1.80E-04
n,n-Dipropyl-4-trifluoromethyl-2,6-dinitroaniline	1582-09-8	5.40E+02	1.80E+02	5.00E-01
Di-n-Butyl Phthalate	84-74-2	8.30E+01	4.00E+01	---
Di-n-Octyl Phthalate	117-84-0	8.00E+01	4.00E+01	---
Diphenylamine	122-39-4	1.70E+02	7.90E+01	---
Dithane	8018-01-7	2.40E+02	8.00E+01	---
2-Ethoxy Ethyl Acetate	111-15-9	8.00E+02	2.00E+02	---
Endosulfan	115-29-7	2.40E+00	8.00E-01	---
Endrin	72-20-8	2.50E+00	7.90E-01	---
Epichlorohydrin	106-89-8	1.70E+02	6.30E+01	4.70E-01
Ethanol	64-17-5	---	1.40E+04	---

[1] AAAQG values from July 15, 1992 list

Pollutant	CAS#	AAAQG Value (µg/m³) [1]		
		1-Hour	24-Hour	Annual
Ethyl Acetate	141-78-6	4.20E+04	1.10E+04	---
Ethyl Parathion	56-38-2	2.50E+00	8.00E-01	---
Ethyl-3-Ethoxy Propionate	763-69-9	3.80E+02	2.40E+02	---
Ethylbenzene	100-41-4	4.50E+03	3.50E+03	---
Ethylene Glycol Dimethyl Ether	110-71-4	4.90E+02	1.30E+02	---
Ethylene Glycol Monopropyl Ether	2807-30-9	7.20E+02	1.90E+02	---
Ethylene Oxide	75-21-8	1.40E+01	3.70E+00	1.00E-02
Fiberglass	14808-60-7	150 g	40 g	---
Fluorine	7782-41-4	6.00E+00	1.60E+00	---
Formaldehyde	50-00-0	2.00E+01	1.20E+01	8.00E-02
Formic Acid	64-18-6	2.70E+02	7.10E+01	---
Glycerol	56-81-5	2.25E+02	7.50E+01	---
Glycol Monobutylether Acetate	112-07-2	7.20E+02	1.90E+02	---
1-Hydroxy-2-Propanone	116-09-6	1.50E+02	4.00E+01	---
2-Heptanone	110-43-0	---	3.50E+03	---
Heptachlor	76-44-8	1.50E+00	4.00E-01	1.10E-03
Heptachlor Epoxide	1024-57-3	7.60E-01	2.00E-01	5.40E-04
n-Heptane	142-82-5	1.70E+04	1.10E+04	---
Hexachlorobenzene	118-74-1	3.70E+00	9.90E-01	2.70E-03
Hexachlorobutadiene	87-68-3	7.20E+00	1.90E+00	6.70E-02
Hexachlorocyclohexane (all isomers)	58-89-9	1.10E+00	3.00E-01	8.10E-04
Hexachlorocyclopentadiene	77-47-4	2.50E+00	7.90E-01	---
Hexachloroethane	67-72-1	3.00E+02	7.90E+01	3.40E-01
n-Hexane	110-54-3	5.30E+03	1.40E+03	---
Hydrochloric Acid (Hydrogen Chloride)	7647-01-0	2.10E+02	5.60E+01	7.00E+00
Hydrofluoric Acid (Hydrogen Floride)	7664-39-3	5.63E+02	1.88E+02	---
Hydrogen Cyanide	74-90-8	4.00E+01	4.00E+01	---
Hydrogen Sulfide	7783-06-4	1.80E+02	1.10E+02	---
Iron (II) Chloride	7758-94-3	3.00E+01	7.90E+00	---
Iron (II, III) Oxide	1317-61-9	8.30E+01	4.00E+01	---
Iron (III) Chloride	7705-08-0	3.00E+01	7.90E+00	---
Iron (III) Oxide	1309-37-1	1.10E+02	3.80E+01	---
Iron compounds (insoluble)	---	1.50E+02	4.00E+01	---
Iron compounds (soluble)	---	2.25E+01	7.50E+00	---
Isobutyl Acetate	110-19-0	---	5.30E+03	---
Isobutyl Alcohol	78-83-1	1.90E+03	1.20E+03	---
Isobutyl Isobutyrate	97-85-8	---	1.10E+03	---
Isopropanol	67-63-0	---	7.40E+03	---
Isopropyl Acetate	108-21-4	9.90E+03	7.50E+03	---
1-Methoxy-2-Propanol Acetate	108-65-5	7.20E+02	1.90E+02	---
3-Methylcholanthrene	56-49-5	7.90E-01	2.10E-01	5.70E-04
4,4-Methylene-bis-2-chloroanaline	101-14-4	6.40E+00	1.70E+00	---

[1] AAAQG values from July 15, 1992 list

Pollutant	CAS#	AAAQG Value ($\mu g/m^3$) [1]		
		1-Hour	24-Hour	Annual
Magnesium Fluoride	7783-40-6	7.60E+01	2.00E+01	---
Magnesium Oxide (respirable fraction)	1309-48-4	1.50E+02	4.00E+01	---
Magnesium Oxide (total dust)	1309-48-4	3.00E+02	8.00E+01	---
Magnesium Silicate	1343-90-4	6.00E+01	1.60E+01	---
Malathion	121-75-5	2.40E+02	8.00E+01	---
Manganese (metal or fume)	7439-96-5	2.50E+01	8.00E+00	---
Manganese Dioxide	1313-13-9	2.50E+01	8.00E+00	---
Mercury	7439-97-6	1.50E+00	4.00E-01	---
Methanol	67-56-1	2.60E+03	2.10E+03	---
Methomyl	16752-77-5	7.60E+01	2.00E+01	---
Methoxychlor	72-43-5	1.50E+02	4.00E+01	---
Methyl Ethyl Ketone (2-Butanone)	78-93-3	7.40E+03	4.70E+03	---
Methyl n-Butyl Ketone	591-78-6	6.00E+02	1.60E+02	---
Methyl Parathion	298-00-0	4.80E+00	1.60E+00	---
Methylhydrazine	60-34-4	3.00E+00	8.00E-01	2.20E-03
a-Methystyrene	98-83-9	4.00E+03	1.90E+03	---
Molybdenum Trioxide	1313-27-5	8.30E+01	4.00E+01	---
Myclobutanil (Systhane)	88671-89-0	2.40E+02	8.00E+01	---
2-Nitropropane	79-46-9	5.80E+02	2.80E+02	7.70E-01
Naphthalene	91-20-3	6.30E+02	4.00E+02	---
Nickel (metal or fume)	7440-02-0	5.70E+00	1.50E+00	4.00E-03
Nickel Acetate	373-02-4	2.25E+00	7.50E-01	---
Nitric Acid	7697-37-2	1.13E+02	3.75E+01	---
Nitric Oxide	10102-43-9	6.90E+02	2.30E+02	---
Nitrobenzene	98-95-3	8.30E+01	4.00E+01	---
n-Nitrosodiethylamine	55-18-5	1.50E-01	4.00E-02	1.10E-04
n-Nitrosodimethylamine	62-75-9	2.50E-01	6.60E-02	1.80E-04
n-Nitroso-di-n-butylamine	924-16-3	1.20E+00	3.20E-01	8.70E-04
n-Nitrosopyrrolidine	930-55-2	3.00E+00	8.00E-01	2.20E-03
Octane	111-65-9	1.10E+04	2.90E+03	---
Oxoheptyl Acetate	90438-79-2	7.90E+03	5.60E+03	---
Oxohexyl Acetate	---	7.20E+02	1.90E+02	---
2-Pentanone	107-87-9	7.30E+03	4.20E+03	---
Pentachlorobenzene	608-93-5	1.50E+01	4.00E+00	---
Pentachloronitrobenzene	82-68-8	6.80E+00	1.80E+00	4.90E-03
Pentachlorophenol	87-86-5	1.30E+01	4.00E+00	---
Pentanal	110-62-3	5.30E+03	1.40E+03	---
Pentane	109-66-8	1.30E+04	3.50E+03	---
Phenol	108-95-2	3.20E+02	1.50E+02	---
Phenylmercuric Acetate	62-38-4	2.50E-01	7.90E-02	---
Phosmet	732-11-6	2.40E+02	8.00E+01	---
Phosphamidon	297-99-4	3.00E-01	1.00E-01	---

[1] AAAQG values from July 15, 1992 list

Pollutant	CAS#	AAAQG Value (μg/m³) [1]		
		1-Hour	24-Hour	Annual
Phosphine	7803-51-2	---	3.00E+00	---
Phosphoric Acid	7664-38-2	---	7.50E+00	---
Phosphorus Pentafluoride	7647-19-0	---	7.50E+00	---
Phosphorus Pentasulfide	1314-80-3	2.40E+01	7.90E+00	---
Phosphorus Pentoxide	1314-56-3	2.40E+01	7.90E+00	---
Polychlorinated Biphenyls (PCBs)	1336-36-3	3.00E-01	7.90E-02	6.10E-04
Potassium Carbonate	584-08-7	4.50E+02	1.20E+02	---
Potassium Fluoride	7789-23-3	7.60E+01	2.00E+01	---
Potassium Hydroxide	1310-58-3	6.00E+01	1.60E+01	---
p-Phenylenediamine	106-50-3	3.00E+00	7.90E-01	---
Pronamide	23950-58-5	1.90E+01	5.10E+00	1.40E-02
Propane (asphyxiant)	74-98-6	---	1.40E+04	---
n-Propanol	71-23-8	5.20E+03	4.00E+03	---
Propionic Acid	79-09-6	3.80E+02	2.40E+02	---
n-Propyl Acetate	109-60-4	8.80E+03	6.70E+03	---
Propylene Glycol, Monomethyl Ether	107-98-2	4.50E+03	2.90E+03	---
Propylene Oxide	75-56-9	1.50E+03	4.00E+02	2.00E+00
Pyridine	110-86-1	2.50E+02	1.20E+02	---
Selenium	7782-49-2	6.00E+00	1.60E+00	---
Silane	7803-62-5	---	5.30E+00	---
Silica (amorphous hydrated)	7631-86-9	1.80E+02	4.80E+01	---
Silver	7440-22-4	3.00E-01	7.90E-02	---
Sodium Aluminofluoride (Cryolite)	15096-52-3	6.00E+01	2.00E+01	---
Sodium Fluoride	7681-49-4	7.60E+01	2.00E+01	---
Sodium Hydroxide	1310-73-2	4.50E+01	1.50E+01	---
Sodium Sulfate	7757-82-6	1.50E+02	5.00E+01	---
Strychnine	57-24-9	3.80E+00	1.20E+00	---
Styrene	100-42-5	3.50E+03	1.70E+03	---
Sulfuric Acid	7664-93-9	2.25E+01	7.50E+00	---
1,1,1-Trichloroethane (Methyl Chloroform)	71-55-6	2.00E+04	1.10E+03	---
1,1,2,2-Tetrachloroethane	79-34-5	3.30E+01	8.80E+00	2.40E-02
1,1,2-Trichloroethane	79-00-5	7.50E+02	3.00E+01	8.20E-02
1,2,4,5-Tetrachlorobenzene	95-94-3	1.50E+01	9.00E+00	---
1,2,4-Trichlorobenzene	120-82-1	1.20E+03	3.20E+02	---
1,2,4-Trimethylbenzene	95-63-6	---	1.42E+03	---
1,3,5-Trimethylbenzene	108-67-8	---	1.09E+03	---
2,2,4-Trimethyl-1,3-Pentanediol Isobutyrate	25265-77-4	3.00E+02	8.00E+01	---
2,3,7,8-Tetrachlorodibenzo-p-Dioxin [2,3,7,8-TCDD]	1746-01-6	4.20E-02	1.10E-02	2.40E-05
2,4,5-Trichlorophenol	95-95-4	1.30E+04	3.50E+03	---
2,4,6-Trichlorophenol	88-06-2	6.00E+02	1.60E+02	4.30E-01
Talc	14807-96-6	---	5.00E+06	---

[1] AAAQG values from July 15, 1992 list

Pollutant	CAS#	AAAQG Value (μg/m³) [1]		
		1-Hour	24-Hour	Annual
Tetrachloroethylene (Perchloroethylene)	127-18-4	1.10E+04	7.70E+02	2.10E+00
Tetraethyl Lead	78-00-2	2.50E+00	5.90E-01	---
Tetrafluoromethane	75-73-0	---	3.00E+02	---
Thallium	7440-28-0	3.00E+00	7.90E-01	---
Thorium 232	7440-29-1	70 c	2.9 c	8.0E-03 c
Titanium Dioxide (respirable dust)	13463-67-7	1.50E+02	4.00E+01	---
Titanium Dioxide (total dust)	13463-67-7	3.00E+02	8.00E+01	---
Toluene	108-88-3	4.70E+03	3.00E+03	---
Toxaphene	8001-35-2	8.30E+00	1.50E+00	4.00E-03
Trichloroethylene (TCE)	79-01-6	1.10E+03	2.80E+02	7.60E-01
Trichlorofluoromethane	75-69-4	2.20E+05	5.90E+04	---
Trichlorotrifluoroethane	76-13-1	7.90E+04	6.00E+04	---
Triethylenetetramine	112-24-3	7.60E+02	2.00E+02	---
Tungsten Trioxide	1314-35-8	8.30E+01	4.00E+01	---
Uranium 238 (insoluable)	7440-61-1	7.50E+00	2.00E+00	---
Uranium 238 (soluable)	7440-61-1	1.50E+00	4.00E-01	---
Vanadium	7440-62-2	1.50E+00	4.00E-01	---
Vinyl Chloride	75-01-4	1.70E+01	4.40E+00	1.20E-02
Xylene (mixed isomers)	1330-20-7	5.50E+03	3.50E+03	---
m-Xylene	108-38-3	5.50E+03	3.50E+03	---
o-Xylene	95-47-6	5.50E+03	3.50E+03	---
p-Xylene	106-42-3	5.50E+03	3.50E+03	---
Zinc Chloride	7646-85-7	1.70E+01	8.00E+00	---
Zinc Oxide (fume)	1314-13-2	8.30E+01	4.00E+01	---
Zinc Oxide (respirable dust)	1314-13-2	1.50E+02	4.00E+01	---
Zinc Oxide (total dust)	1314-13-2	3.00E+02	8.00E+01	---
Zinc Stearate	557-05-1	---	3.50E+02	---
Zirconium	7440-67-7	1.10E+02	3.80E+01	---
Zirconium Carbide	12070-14-3	1.50E+02	4.00E+01	---
Zirconium Oxide	1314-23-4	1.10E+02	3.80E+01	---

[1] AAAQG values from July 15, 1992 list

APPENDIX C

MODELING PROTOCOL ELEMENTS

ADEQ recognizes that many air quality specialists have their own preferred formats for protocols. ADEQ does not wish to require permit applicants to use a specific modeling protocol format mandated by ADEQ. Instead, ADEQ has generated a listing of typical protocol elements as an aid in developing a modeling protocol. This listing does not address all possible components of a protocol. Case-by-case judgments should be used to decide if additional aspects of the analysis should be included in the protocol or if certain elements are not necessary in a given situation.

An example modeling protocol outline for a major stationary source subject to PSD is provided below.

Introduction and Project Background Information
- Company and facility name.
- Permit number and type of permit.
- Overview of the project, project location, and general brief description of facility operations.
- Facility and project classification.
- Description of the federal and Arizona regulations and guidelines that pertain to the proposed project.
- Attainment status classification for the source location.
- Description of baseline dates and baseline areas (if applicable).

General Regional Characteristics
- Maps and description of local topography and areas surrounding the facility.
- Description of regional climatology and meteorology.

Detailed Facility Layout
It is essential that the applicant provide ADEQ a detailed facility plot plan and description of the facility. The source must provide a *scaled site plot plan with a north arrow* indicated that contains the following information:

- Locations of emission points (i.e. smokestacks, vents, etc.) at the facility. Please clearly label all emission points that will be modeled. These emission point names should be traceable to a table that contains other required modeling information such as stack parameters and emission rates (see example in Appendix D).
- Locations of process equipment (i.e. storage tanks, silos, conveyors, etc.), lay down areas, parking lots, haul roads, maintenance roads, storage piles, etc.
- Locations of all buildings at the facility. In addition, the applicant must indicate the height of each building (for single tiered buildings) and/or the height of each building tier (for multi-tiered buildings) on a site plot plan.
- Locations of the facility's fence line and process area boundaries (see Appendix A).
- Locations and names of adjacent roads and properties to the facility (if applicable).
- Locations of nearest residences, schools, and offsite workplaces.

Emission Profiles
- Identify all emission units included in the modeling analysis and make them traceable to a facility plot plan.

- Identify maximum potential short-term emission rates for all modeled pollutants in lb/hr (or lb/day) and an associated g/sec emission rate. The maximum short-term emission rates for each source should be used to demonstrate compliance with all short-term averaging standards and guidelines. It is important that the applicant provide emissions information for all averaging times to be considered in the modeling analysis. Potential short-term emissions "spikes" from highly fluctuating short-term emissions sources (such as some types of kilns) also need to be characterized and considered in the modeling analysis.
- Identify maximum potential long-term emission rates for all modeled pollutants in ton/yr and an associated g/sec emission rate.
- Identify hr/day and hr/yr operational limits assumed for each source.

Loads Analysis

A loads analysis is required for equipment that may operate under a variety of conditions that could affect emission rates and dispersion characteristics. A loads analysis is a preliminary modeling exercise in which combinations of parameters (e.g. ambient temperature, sources loads, relative humidity, etc.) are analyzed to determine which combination leads to the highest modeled impact. For example, turbines should be evaluated at varying loads and temperatures to determine the worst-case modeled impacts.

Stack Parameters
- Describe how each modeled source is characterized (i.e. point source, area source, volume source, etc.). For stacks, please indicate if the stack is oriented vertically/horizontally and if the stack has a fixed rain cap.
- List assumed stack parameters and make this information traceable to a facility plot plan and emission inventory tables.

Modeling Approach
- Description of model selection.
- Description of model inputs/defaults and modeling methods proposed.
- Pollutants and sources considered.
- Land use classification analysis.
- Description of process area boundaries.
- Proposed process area boundary and receptor grid configurations.
- Identification of the coordinate system and datum used to identify the receptors.
- Discussion regarding the meteorological data proposed.
- Justification for the use of meteorological data if the meteorological data is not based on site-specific data.
- Good Engineering Practice (GEP) stack height analysis.
- Justification of the background air quality monitoring data to be used.

Off-site Impacts
- Document if and how off-site facilities were addressed in the analysis.
- Discuss whether any off-site sources were eliminated from the analysis.

Special Modeling Considerations
- Describe the approach for addressing visibility, Class I Area modeling, effects on soils and vegetation, growth analysis, characterization of fugitive emissions, etc.

APPENDIX D

**MINIMUM INFORMATION REQUIRED FOR
ADEQ IN-HOUSE MODELING EVAULATIONS**

Section D.I provides an overview pertaining to when modeling is performed in-house at ADEQ. Section D.II describes the basic types of modeling analyses required by ADEQ. Section D.III outlines the information necessary to complete an in-house modeling analysis. Section D.IV provides an example of the information that should be provided to the Modeling Manager so that a modeling analysis can be performed in-house at ADEQ. Appendix B provides an Arizona Ambient Air Quality Guidelines (AAAQG) list dated July 15, 1992 which should be used to determine which pollutants should be considered in an AAAQG analysis.

D.I.   In-House Modeling Overview

ADEQ typically performs in-house modeling for small operations (Class II permits) where it may be cost and/or resource prohibitive for the source to complete its own modeling analyses in support of an air quality permit application. In some instances, ADEQ may also model more complex, controversial projects where the State needs to have an independent answer on an air quality issue separate from a company's modeling analysis. Outside of these circumstances, it is expected that the permittee submit a modeling analysis in support of an air permit application.

D.II.   Types of Modeling Analyses

As part of the air permitting process for non-PSD sources/projects, ADEQ requires the completion of two types of modeling analyses, a NAAQS analysis and an AAAQG analysis.

NAAQS Analysis
The Clean Air Act requires EPA to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. ADEQ requires that sources perform modeling analyses for comparison to the NAAQS for certain criteria pollutants. The NAAQS analysis considers impacts from emissions of:

- Carbon Monoxide (CO),
- Nitrogen Oxides (NOx),
- Sulfur Dioxide (SO2),
- Particulate Matter less than 10 micrometers in diameter (PM_{10}), and
- Lead (Pb).

As part of the air permitting process, modeling is not typically performed for volatile organic compounds (VOCs) or ozone (O_3).

AAAQG Analysis
In addition to the NAAQS analysis, ADEQ requires that sources meet the Arizona Ambient Air Quality Guidelines (AAAQGs) for Arizona toxics. AAAQGs are screening values that are protective of human health, including children. It is not intended for AAAQGs to be used as standards. Rather, they are intended to provide health-based guidelines that may be useful in making environmental risk management decisions.

In 1992, the Arizona Department of Health Services (ADHS) established the Arizona Ambient Air Quality Guideline (AAAQG) values for various toxic air pollutants. ADHS revised the AAAQG values in 1999. However, ADEQ currently requires sources to demonstrate that the maximum modeled offsite impacts are less than the values listed in the July 15, 1992 AAAQG list (see Appendix B). Until the values from the 1999 list are adopted by ADEQ through a stakeholder process, ADEQ will continue to require modeling of all pollutants that are included on the July 15, 1992 AAAQG list.

In some situations, some pollutants may not initially appear to be AAAQG pollutants. However, it is common for pollutants to have synonyms that might be included on the AAAQG list. Therefore, informational sources such as http://www.chemfinder.com/ should be utilized to determine pollutant synonyms for AAAQG pollutants to ensure that all AAAQG pollutants are included in the AAAQG analysis.

D.III. Information Necessary to Complete In-House Modeling Analyses

The following information is required for modeling analyses in support of air permit applications:

Permit Application Information
- Company and facility name.
- Permit number and type of permit.
- Brief description of facility operations.

Facility Location Information
- Street address of the facility. Please use http://www.mapquest.com/ to check that the street address is valid.
- Facility location in Universal Transverse Mercator (UTM) coordinates (easting and northing in either NAD27 or NAD83 systems) or Latitude/Longitude (degrees, minutes, seconds). This information can be obtained from http://www.topozone.com/ and other sources.

Scaled Plot Plan
To complete a modeling analysis, it is essential that the source provide ADEQ a detailed facility plot plan. The source must provide a *scaled site plot plan with a north arrow* indicated that contains the following information:

- Locations of emission points (i.e. smokestacks, vents, etc.) at the facility. Please clearly label all emission points that will be modeled. These emission point names should be traceable to a table that contains other required modeling information (see example in Section D.IV).
- Locations of all process equipment (i.e. storage tanks, silos, conveyors, etc.), lay down areas, parking lots, haul roads, maintenance roads, storage piles, etc.
- Locations of all buildings at the facility. In addition, the source must indicate the height of each building (for single tiered buildings) and/or the height of each building tier (for multi-tiered buildings) on the site plot plan.
- Locations of the facility's property boundary and fence line.
- Locations and names of adjacent roads and properties to the facility (if applicable).
- Locations of nearest residences, schools, and offsite workplaces.

Emission Point Information

For each source to be modeled, detailed emission, operating schedule, and stack parameter information is required. When making applicability determinations, it is necessary to tabulate emissions for individual pieces of equipment. However, modeling pertains to individual release points (i.e. smokestacks, vents, etc.) to the atmosphere rather than individual pieces of equipment.

For example, if three boilers release to the atmosphere through a common "boiler stack", then one must add the emissions from the three boilers together so that dispersion modeling can be performed for the single "boiler stack."

Section D.IV provides an example that highlights emissions and stack parameters information necessary for modeling. Since modeling is handled on a case-by-case basis, this example should be modified as necessary to fit the permittee's operations.

For reference, an electronic spreadsheet named "Emission Point Information.xls" is available from ADEQ's Assessment Section to expedite the tabulation of emission point information.

For each source to be modeled, please provide:

- The operating schedule of the stack (hours/day and hours/year).
- Maximum hourly emission rate for each criteria and/or AAAQG pollutant.
- Stack parameters (i.e. stack height above grade, stack diameter, stack exhaust temperature, stack exit velocity) for each source.
- Please indicate if the stack is oriented vertically/horizontally.
- Please indicate if the stack has a fixed rain cap.

Emission sources such a storage piles, lagoons, conveyor drop points, haul roads, quarries, mining pits, etc. require much different input data than smokestacks. If the emission source to be modeled is not a smokestack, please contact the Permit Modeler to discuss.

D.IV. Example Modeling Request

This section provides an example of a modeling request that might be provided to the Modeling Manager. The example is based on a fictional facility which has two natural-gas fired boilers and one natural-gas fired generator with different operating schedules. This format should not serve directly as a template as the number of sources and emissions vary significantly from facility to facility. Please edit the electronic file "Emission Point Information.xls" to generate your specific modeling request. In addition, include any other information (i.e. numerous maps, flow diagrams, etc.) that might be useful for the Permit Modeler to understand the location and operations of the facility.

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY
INTEROFFICE MEMORANDUM

TO: Peter Hyde, Manager Modeling Unit

FROM: Your Name, Permit Engineer

DATE: November 19, 2003

RE: Request for Modeling

Please perform a modeling analysis for the ACME Company facility located in Winslow, Arizona. The necessary modeling information is as follows:

Permit Application Information	
Company Name:	ACME Company
Facility Name (if applicable):	Winslow Facility
Permit Number:	90210
Type of Permit:	Class II, Synthetic Minor, Significant Revision

Description of Facility Operations:
The ACME Company is a global leader in the widgets manufacturing business. The ACME facility located in Winslow, Arizona manufactures widgets for use in home appliances. The Winslow facility uses two natural gas-fired boilers to provide steam to the widget molding process. In addition, the Winslow facility utilizes a natural gas-fired emergency generator for back-up electricity generation.

Description of Alternate Operating Scenarios (to be modeled):
Not Applicable

Facility Location Information	
Facility Street Address:	1700 N. Park Dr. Winslow, AZ 86047
Facility UTM Coordinates:	Easting (m) = 527,539 Northing (m) = 3,877,322
NAD27 or NAD83 coordinate system?	System = NAD83
Facility Latitude/Longitude:	Latitude = 32 deg, 02 min, 18 sec - North Longitude = 110 deg, 41 min, 53 sec - West

Scaled Site Plot Plan(s)	See Attached
Emission and Stack Parameters [1]	See Attached

[1] Please attach separate emissions calculations for each alternate operating scenario to be modeled

Example of Map Generated from
http://www.mapquest.com/
for ACME Company, Winslow Facility
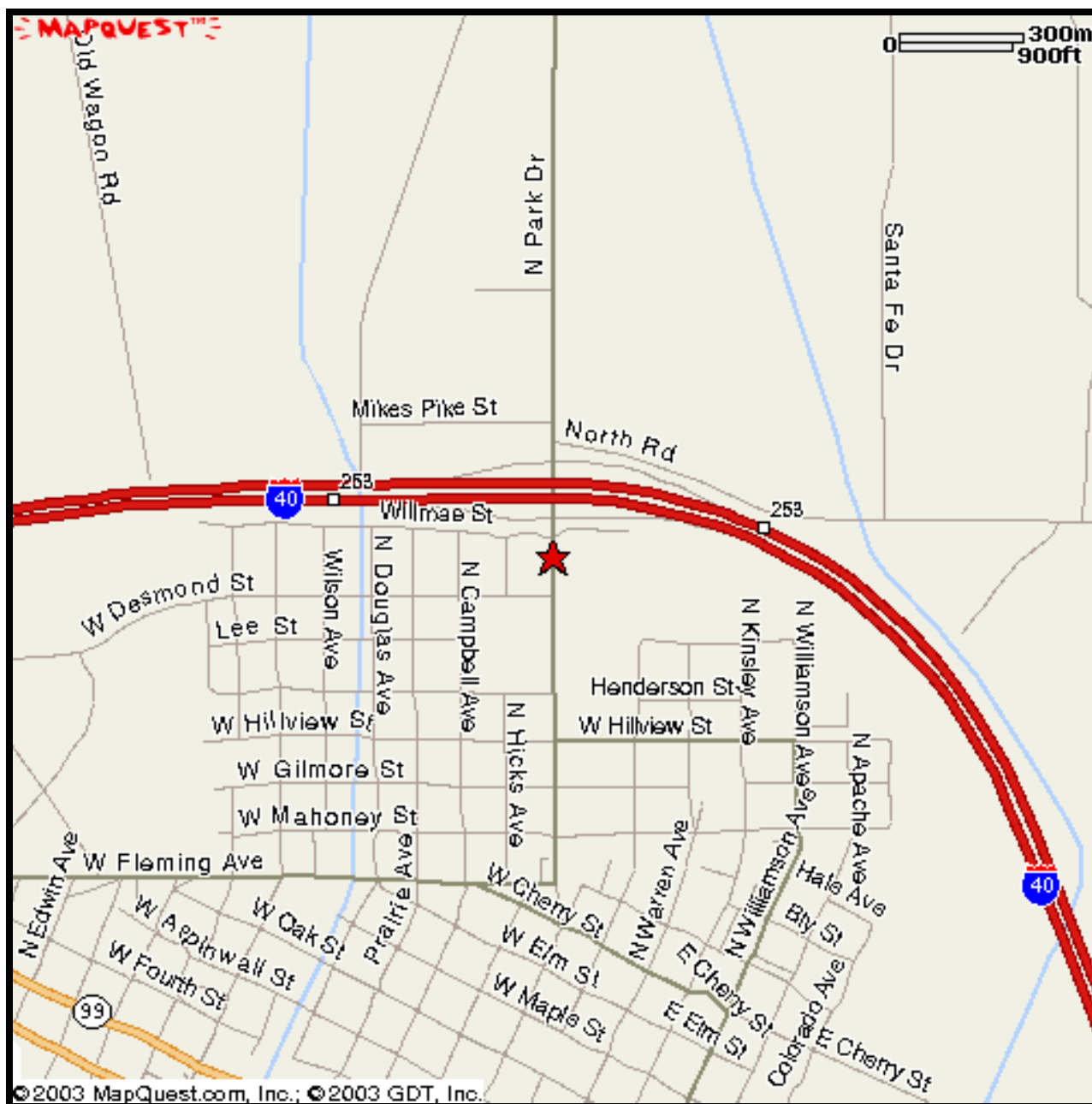
Example of Map Generated from
http://www.topozone.com
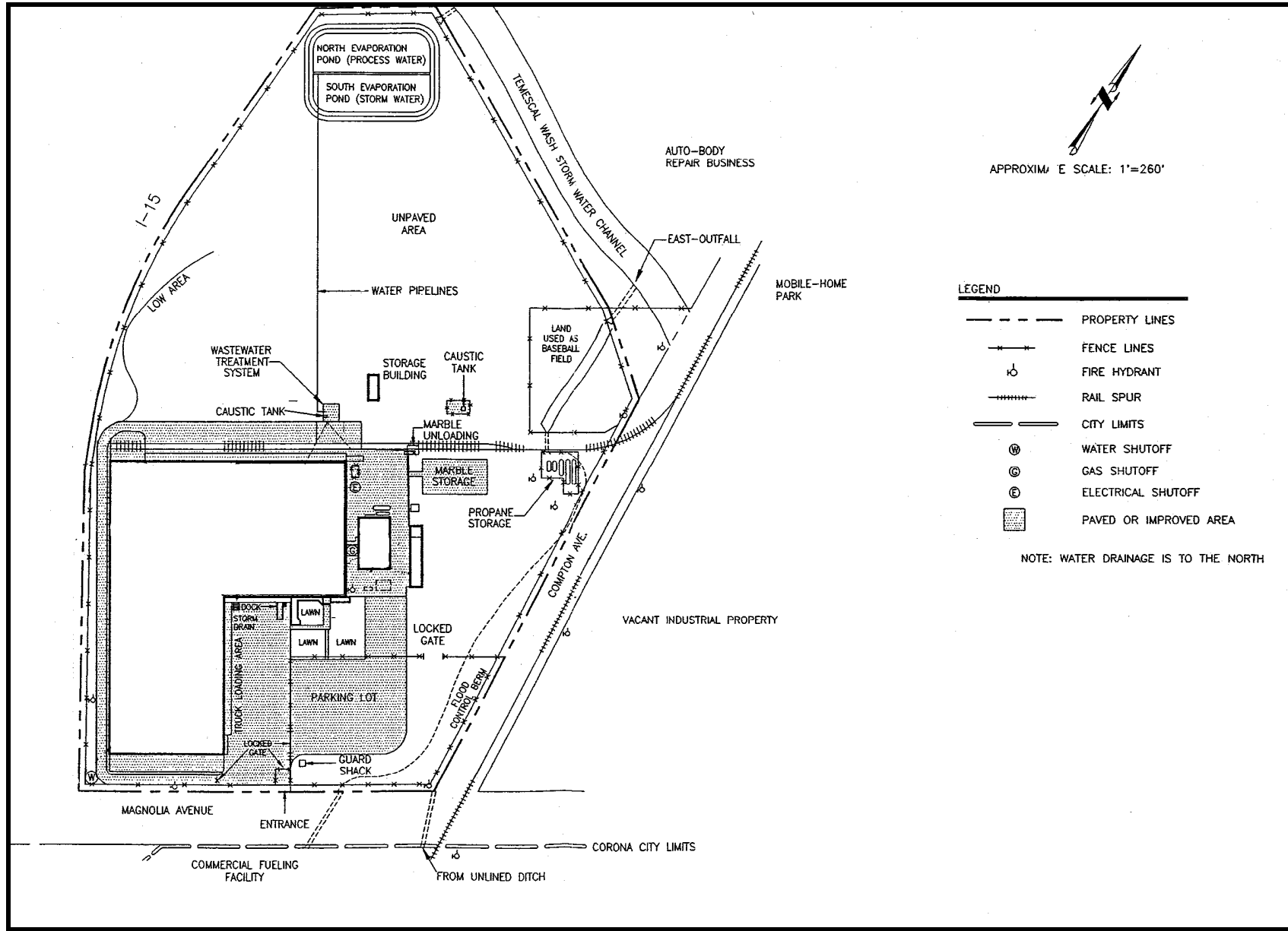**for ACME Company, Winslow Facility**

Note that UTM coordinates are provided above the map
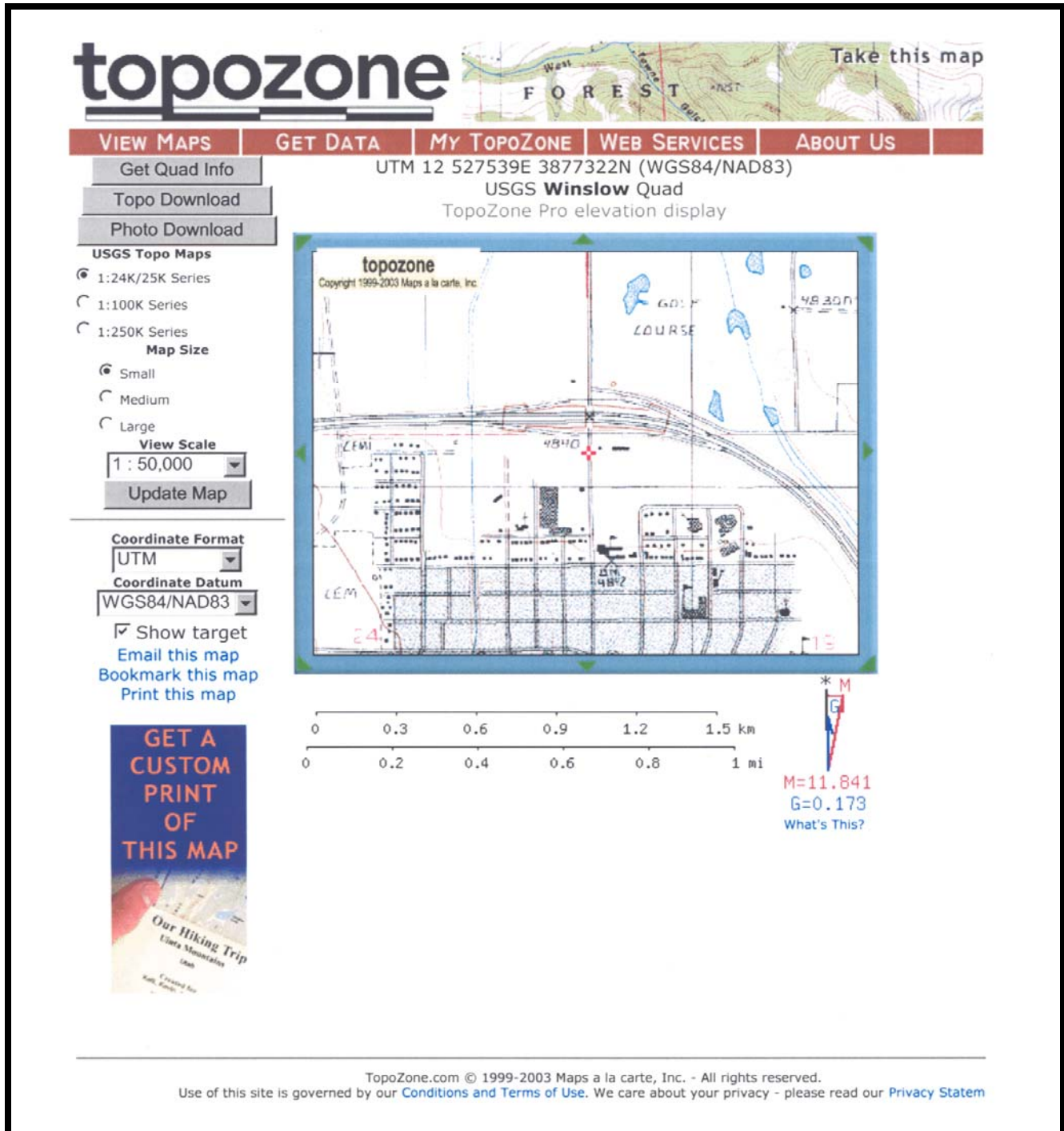
Example of Scaled Site Plot Plan

Stack Parameters

ACME Company
Winslow, Arizona
Modeling Inputs - Stack Parameters

18-Nov-03

Modeled Source Parameters												
Emission Source	**Source Reference**	**Source Type**	**Stack Vertical or Horizontal?**	**Fixed Rain Cap?**	**Release Height [1]**		**Stack Inside Diameter**		**Gas Exit Temperature**		**Gas Flow Rate**	**Exit Velocity**
					(ft)	(m)	(ft)	(m)	(deg F)	(deg K)	(acfm)	(m/s)
Boiler #1	BOIL01	Stack	Vertical	No	27.00	8.23	2.50	0.76	370	461	1,966	2.0
Boiler #2	BOIL02	Stack	Vertical	No	31.00	9.45	1.75	0.53	330	439	826	1.7
Generator	GEN01	Stack	Vertical	No	15.00	4.57	0.50	0.15	994	808	2,175	56.3

N/A = Not applicable

[1] Above plant grade

Denotes input parameter from Permit Engineer

Emissions Summary

ACME Company

Winslow, Arizona

Emissions Totals

18-Nov-03

Operations			
Emission Source	**Max Operating Hours Per Day**	**Max Operating Hours Per Year**	**Fuel**
Boiler #1	24	8,760	Natural Gas
Boiler #2	24	6,000	Natural Gas
Generator	10	500	Natural Gas

Emission Rates			
Pollutant	**Max. 1-Hour (lb/hr)**	**Max. 24-Hour (lb/day)**	**Annual Average (tons/yr)**
Criteria Pollutants			
NOx	13.37	152.90	8.06
CO	6.15	77.65	5.50
PM_{10}	0.20	3.50	0.41
SOx	0.04	0.50	0.04
Lead			
AAAQG Pollutants			
Benzene	4.45E-05	8.60E-04	1.13E-04
Formaldehyde	1.59E-03	3.07E-02	4.04E-03
Hexane	3.81E-02	7.37E-01	9.69E-02
Naphthalene	1.29E-05	2.50E-04	3.29E-05
Pentane	5.51E-02	1.06E+00	1.40E-01
Toluene	7.20E-05	1.39E-03	1.83E-04

Denotes input parameter from Permit Engineer

The AAAQG pollutants list for modeling should always include all emitted
pollutants from a source which are listed on the July 15, 1992 AAAQG list.
Emitted AAAQG pollutants will vary from source to source and project to project.

Boiler #1 Emissions

ACME Company
Winslow, Arizona
Emissions - Boiler #1 (BOIL01)

18-Nov-03

Operations		
hrs/day	**hrs/yr**	**Fuel**
24	8,760	Natural Gas

Emission Rates						
	Max. 1-Hour [1]		Max. 24-Hour		Annual Average	
Pollutant	**(lb/hr)**	**(g/sec)**	**(lb/day)**	**(g/sec)** [2]	**(tons/yr)**	**(g/sec)** [2]
Criteria Pollutants						
NOx	0.69	0.09	16.5	0.09	3.0	0.09
CO	0.58	0.07	13.8	0.07	2.5	0.07
PM$_{10}$	0.05	0.007	1.3	0.007	0.2	0.007
SOx	0.004	0.001	0.1	0.001	0.02	0.001
Lead						
AAAQG Pollutants						
Benzene	1.48E-05	1.87E-06	3.56E-04	1.87E-06	6.49E-05	1.87E-06
Formaldehyde	5.29E-04	6.67E-05	1.27E-02	6.67E-05	2.32E-03	6.67E-05
Hexane	1.27E-02	1.60E-03	3.05E-01	1.60E-03	5.57E-02	1.60E-03
Naphthalene	4.31E-06	5.43E-07	1.03E-04	5.43E-07	1.89E-05	5.43E-07
Pentane	1.84E-02	2.31E-03	4.40E-01	2.31E-03	8.04E-02	2.31E-03
Toluene	2.40E-05	3.02E-06	5.76E-04	3.02E-06	1.05E-04	3.02E-06

[1] Assume 3-hour and 8-hour emission rates are equal to 1-hour emission rate

[2] Emission rate (in g/s) for 24-hour and annual periods is adjusted to account for operations of the facility

Denotes input parameter from Permit Engineer

The AAAQG pollutants list for modeling should always include all emitted

pollutants from a source which are listed on the July 15, 1992 AAAQG list.

Emitted AAAQG pollutants will vary from source to source and project to project.

Boiler #2 Emissions

ACME Company
Winslow, Arizona
Emissions - Boiler #2 (BOIL02)

18-Nov-03

Operations		
hrs/day	**hrs/yr**	**Fuel**
24	6,000	Natural Gas

Emission Rates						
	Max. 1-Hour [1]		**Max. 24-Hour**		**Annual Average**	
Pollutant	**(lb/hr)**	**(g/sec)**	**(lb/day)**	**(g/sec)** [2]	**(tons/yr)**	**(g/sec)** [2]
Criteria Pollutants						
NOx	0.69	0.09	16.5	0.09	2.1	0.06
CO	0.58	0.07	13.8	0.07	1.7	0.05
PM$_{10}$	0.05	0.007	1.3	0.007	0.2	0.004
SOx	0.004	0.001	0.1	0.001	0.01	0.0004
Lead						
AAAQG Pollutants						
Benzene	1.48E-05	1.87E-06	3.56E-04	1.87E-06	4.45E-05	1.28E-06
Formaldehyde	5.29E-04	6.67E-05	1.27E-02	6.67E-05	1.59E-03	4.57E-05
Hexane	1.27E-02	1.60E-03	3.05E-01	1.60E-03	3.81E-02	1.10E-03
Naphthalene	4.31E-06	5.43E-07	1.03E-04	5.43E-07	1.29E-05	3.72E-07
Pentane	1.84E-02	2.31E-03	4.40E-01	2.31E-03	5.51E-02	1.58E-03
Toluene	2.40E-05	3.02E-06	5.76E-04	3.02E-06	7.20E-05	2.07E-06

[1] Assume 3-hour and 8-hour emission rates are equal to 1-hour emission rate

[2] Emission rate (in g/s) for 24-hour and annual periods is adjusted to account for operations of the facility

Denotes input parameter from Permit Engineer

The AAAQG pollutants list for modeling should always include all emitted

pollutants from a source which are listed on the July 15, 1992 AAAQG list.

Emitted AAAQG pollutants will vary from source to source and project to project.

Generator Emissions

ACME Company
Winslow, Arizona
Emissions - Generator (GEN01)

18-Nov-03

Operations		
hrs/day	**hrs/yr**	**Fuel**
10	500	Natural Gas

Emission Rates						
	Max. 1-Hour [1]		**Max. 24-Hour**		**Annual Average**	
Pollutant	**(lb/hr)**	**(g/sec)**	**(lb/day)**	**(g/sec)** [2]	**(tons/yr)**	**(g/sec)** [2]
Criteria Pollutants						
NOx	12.00	1.51	120.0	0.63	3.0	0.09
CO	5.00	0.63	50.0	0.26	1.3	0.04
PM_{10}	0.10	0.01	1.0	0.01	0.03	0.0007
SOx	0.03	0.004	0.30	0.002	0.01	0.0002
Lead						
AAAQG Pollutants						
Benzene	1.48E-05	1.87E-06	1.48E-04	7.78E-07	3.71E-06	1.07E-07
Formaldehyde	5.29E-04	6.67E-05	5.29E-03	2.78E-05	1.32E-04	3.81E-06
Hexane	1.27E-02	1.60E-03	1.27E-01	6.67E-04	3.18E-03	9.14E-05
Naphthalene	4.31E-06	5.43E-07	4.31E-05	2.26E-07	1.08E-06	3.10E-08
Pentane	1.84E-02	2.31E-03	1.84E-01	9.64E-04	4.59E-03	1.32E-04
Toluene	2.40E-05	3.02E-06	2.40E-04	1.26E-06	6.00E-06	1.73E-07

[1] Assume 3-hour and 8-hour emission rates are equal to 1-hour emission rate

[2] Emission rate (in g/s) for 24-hour and annual periods is adjusted to account for operations of the facility

Denotes input parameter from Permit Engineer

The AAAQG pollutants list for modeling should always include all emitted

pollutants from a source which are listed on the July 15, 1992 AAAQG list.

Emitted AAAQG pollutants will vary from source to source and project to project.